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CUBAN NUCLEAR REACTORS

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY, NUCLEAR PROLIFERATION, AND
GOVERNMENT PROCESSES

OF THE

COMMITTEE ON
GOVERNMENTAL AFFAIRS
UNITED STATES SENATE

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CUBAN NUCLEAR REACTORS

MONDAY, JUNE 30, 1986

U.S. SENATE,
SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION,
AND GOVERNMENT PROCESSES,
COMMITTEE ON GOVERNMENTAL AFFAIRS,
Miami, FL.

The subcommittee met, pursuant to notice, at 10 a.m., in the commission chambers, Metro-Dade Government Center, Hon. Thad Cochran presiding.

Present: Senators Cochran and Hawkins.

OPENING STATEMENT OF SENATOR COCHRAN

Senator COCHRAN. The subcommittee will please come to order.

This is a hearing of the Subcommittee on Energy, Nuclear Proliferation, and Government Processes of the U.S. Senate.

The hearing is being conducted today at the request of the distinguished Senator from Florida, Mrs. Paula Hawkins, to examine the uncertainties associated with the Cuban power facilities under construction at Cienfuegos.

At issue are the safety features of the reactors, the potential consequences to the United States of a nuclear accident in Cuba, and actions which our Government is taking to increase the likelihood of the safe operation of the Cuban reactors.

The Chernobyl nuclear accident has reawakened the world community to the need for strong safety standards in the design, construction, and operation of nuclear powerplants around the world.

In coming months we will see much international activity in the field of nuclear safety—activity which should be of interest to all of us.

An example of our country's vital stake in international nuclear safety relates to recent activity off the coast of southern Florida.

The Soviet Union is building two nuclear power reactors in Cuba, and—while it is encouraging to note that the reactors are significantly different from the Chernobyl plant—this construction is of concern to the United States, since a major radioactive release from a reactor in Cuba might reach our shores, depending upon the severity of the accident and the meteorological factors involved.

We will have three panels of witnesses to testify at this hearing today.

First: Marcelo Alonso, of the Florida Institute of Technology, who will review the development of the Cuban nuclear program.

A native of Havana, Dr. Alonso has served as Executive Secretary of the Inter-American Nuclear Energy Commission and as the

Director of Science and Technology of the Organization of American States.

There will be a panel of Federal agency representatives who will deal with specific aspects of the Cuban construction.

There will also be testimony concerning meteorological factors that might influence the impact upon the United States of any nuclear accident.

We will have representatives of the Department of State, as well.

The hearing will close with the testimony of Robert Nave, Assistant Director of Energy Management, from the State of Florida, who will discuss Florida's preparedness to deal with problems associated with a nuclear accident.

I want to welcome the witnesses and to express appreciation for their cooperation at this hearing.

Let me also express my thanks to the Senator from Florida, Mrs. Hawkins, for her efforts to help bring the attention of the U.S. Senate to this potential problem here in this area of our country.

Let me now recognize Senator Hawkins for any comments that she might have.

TESTIMONY OF HON. PAULA HAWKINS, U.S. SENATOR FROM THE STATE OF FLORIDA

Senator HAWKINS. Thank you, Mr. Chairman; thank you for your leadership in this question of vital interest to the United States of America.

I am pleased that you called this forum today.

In April, while I was recovering from surgery, it was first brought to my attention that the Soviet Union was constructing this nuclear powerplant in the Province of Cienfuegos, Cuba, and I will show you the picture.

Here in the United States we have a comprehensive system for regulating nuclear power; we have stringent standards which are imposed in the construction of nuclear powerplants, and we do this because we have no desire to subject ourselves and our children to the consequences that would surely follow if we were lax, but today we are dealing with the Soviet reactors—Soviet design and Soviet technology—and I was so concerned that I sent a letter to Mr. Gorbachev, and I asked him to stop construction of the Cienfuegos reactors.

The Chernobyl disaster was still fresh in this Senator's mind, and I was anxious to see that the United States would not be forced—against our will—to face that type of calamity.

In the accident at Chernobyl there was at least a partial meltdown of the reactor's core, as an intense fire raged out of control for at least 3 days—spewing lethal radiation into the atmosphere.

I would do an injustice to our discussion here today if I did not point out here and now that the Cienfuegos reactor is different from the reactor at Chernobyl, and, therefore, that it is unlikely that a Chernobyl-style accident would or could happen at Cienfuegos, but I am not sure that it would not happen.

For one thing, they tell us that they are not going to use graphite, which was a major factor in the Chernobyl fire, and we are informed that there will be a containment structure at Cienfuegos,

although we do not know what they mean by that at all, and we do not know if that will be comparable to U.S. standards, and, in the worst case scenario at Cienfuegos—if there were a meltdown and radioactivity escaped from the containment building—if the wind were blowing toward Florida, or toward Mississippi I might say, we could see parallels to Chernobyl here in Florida.

The children and the pregnant women were evacuated from Kiev, which is 90 miles away from Chernobyl.

Ninety miles away from Cienfuegos—that is just south of Key West.

The European Economic Community shut down its sale of leafy vegetables from Poland and Hungary because they were afraid of contamination.

Now, Poland is 270 miles away from Chernobyl.

Two hundred and seventy miles away from Cienfuegos—that is about Fort Lauderdale.

Hungary is 405 miles from Chernobyl.

Four hundred and five miles from Cienfuegos—that is Orlando and Tampa.

As we all recall, we first learned about the Chernobyl disaster when radiation was detected in Sweden.

Now, Sweden is 700 miles from Chernobyl, and Pensacola is about 700 miles from Cienfuegos.

Under this scenario, at the very least, there would be detectable radioactivity, and I would stress that detectable radiation is not necessarily dangerous radiation.

When the Sun comes up in the morning you may see it, but just seeing it does not give you sunburn, but it is the same thing.

At the very least, under this scenario, there would be public complaints, and the health authorities would say: "There is no immediate effect on public health," but that would not stop the headlines and it would not stop the fear, and you may be sure that people would be worried about drinking milk for a while.

Would we need to evacuate in the United States?

Would we need to embargo Florida's agricultural products?

Would we need to fear the rain?

We are here today to discuss these concerns and to raise questions regarding the safety of these Soviet-built Cuban reactors, but, unfortunately, the information available is so scarce—given the secrecy which always shrouds Soviet society and that of Soviet satellites.

We do know the following:

In a speech last December, the New Yorks Times quotes Fidel Castro as saying that nuclear contamination and accidents are only problems in capitalist societies where, he said: "Companies are seeking to cut corners and costs."

Castro said that he did not have to worry, because: "Fortunately, we rely upon Soviet technology."

That was last December, but I wonder what he thinks today.

I would like to show you a videotape, Mr. Chairman, from Soviet TV.

It shows the construction at Cienfuegos.

This aired on the evening news on June 14, 1985.

It is in Russian, and I have the translation for you when it is over.

With your permission, we will show that at this time.

Senator COCHRAN. We will see the videotape now.

Senator HAWKINS. It is an interesting film, and the news anchor said that Cuba's first nuclear powerplant was being built in the town of Juragua.

The reporters first said that the first reactor unit would provide 5 times as much energy as was generated in Cuba on the eve of the country's revolution.

The leaders of the Cuban Communist Party and of the Cuban Government are giving this vital installation a particular amount of importance.

This powerplant is at the center of the attention of the whole country.

The rapid development of the energy base is the principal economic mission of the country.

Further development in this field will, to a great degree, depend upon nuclear power stations.

The project engineer—we believe that is his title—was Jose Quintana (phonetic), and he said: "Nuclear energy is something completely new for Cuba, and, therefore, many of us were educated in the Soviet Union, and, for example, I was stationed at the Nobylrescue (phonetic) nuclear powerplant."

At this particular construction site—Juragua—Soviet specialists from Armenian, Polish, and other nuclear powerplants all are at work.

We have Cubans here practically from every province in the country, and all of us are doing everything possible to have our powerplant change over faster to nuclear energy in Cuba.

We make note here that the Cuban's Russian was not entirely intelligible at some points—particularly his pronunciation of the names—and I have the problem.

The reporters—at the conclusion of this tape—said: "In the past 2 years during which the plant has been under construction, Soviet-Cuban specialists—all graduates of Soviet institutes of higher learning—have trained 800 specialists in the field of nuclear powerplant construction."

Very sobering, Mr. Chairman, and I am looking forward to gathering as many facts as we can here today in an attempt to assess whether we are at risk.

Senator COCHRAN. Thank you very much, Senator Hawkins.

Our first witness this morning is Dr. Marcelo Alonso, who was born in Cuba, and who was formerly the Executive Secretary of the Interamerican Nuclear Energy Commission.

He is now with the Florida Institute of Technology, and he is to present an overview of the development of the Cuban nuclear program.

We have a copy of your prepared statement, for which we thank you very sincerely——

Mr. ALONSO. You are very welcome.

Senator COCHRAN [continuing]. But we would encourage you to make any summary comments or to highlight that statement—as you choose.

You may proceed.

TESTIMONY OF MARCELO ALONSO,[1] EXECUTIVE DIRECTOR OF FITRE, FLORIDA INSTITUTE OF TECHNOLOGY

Mr. ALONSO. Thank you very much, Senator Cochran.

I wish to join you in congratulating Senator Paula Hawkins for calling this meeting, and, also, I wish to thank you all for inviting me to join you this morning in connection with something so important as to understand what is going on a little bit south of our borders.

First, I would like to correct something that appeared in the Soviet videotape about the Cuban nuclear powerplant that you just showed us—something which is very interesting.

They claim that, when the nuclear powerplant in Juragua, near Cienfuegos—about 10 miles southwest of Cienfuegos—is completed it will generate 5 times the prerevolutionary power capacity in Cuba, which means in 1959, and that is totally incorrect for two reasons:

The prerevolutionary electric power generating capacity in Cuba in 1959 was roughly 750 megawatts, and not 397, as Fidel Castro and other government officials claim.

Now, if the four nuclear units are completed in Juragua—not just the two that are being built, but two more—it will make for a total of roughly 1,600 or 1,700 megawatts.

They are 440 megawatts each, except that they claim that they will operate only at 417.

That means that it will be roughly 1,600, and I do not see how 1,600 can be 5 times 700 or 750, so that is the first misleading statement in the videotape.

Incidentally, as I said in my report, the official information about the nuclear power program is contained in a recent report—a 1985 report—by the son of Fidel Castro, who is Fidel Castro Diaz-Balart, and who, incidentally, is the chairman of the Nuclear Energy Commission of Cuba, which means that Fidel Castro is paying serious attention to nuclear energy, and, if you will read that statement very clearly, as I say in my report here, it is a combination of a few technical facts, some general expectations, a lot of Socialist propaganda and several inaccuracies, and this is one of them.

Going quickly into the program, as you very well said, Senator Hawkins—in fact, after what you said, I do not think I have to add much more, but the current program calls for the construction of four PWR nuclear power reactors—the type that the Soviets call VVER's—which, in terms of the concept, are identical to the ones built here in Florida.

Another matter is the design, the redundant systems and the safety measures.

Essentially, they are the same as in the United States, and, as was stated, they are different from the Chernobyl reactors, and the type of accident which occurred there would be impossible with these PWR reactors.

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[1] See p. 33 for Dr. Alonso's prepared statement with attachment.

To begin with, they have a negative temperature coefficient, and the graphite reactors have a positive one, and that was one of the reasons for the accident and the consequences of the accident in Chernobyl, but that does not mean that those PWR reactors are necessarily safe, because we do not know whether they are going to be built in accordance with our own standards.

For example, Fidel Castro, Jr., and the Cuban Government also have stated that the reactors will be built in such a way that they will have a containment structure designed to withstand the impact of an airplane flying at about 500 miles per hour, or an earthquake of 8 degrees on the Richter scale, but there are no earthquakes there, anyway, and to withstand a hurricane with 90-foot waves.

That is what he claims.

Now, if that means that he is going to put this type of containment structure around the reactor vessel and the reactor structure, that might be encouraging, but it is not positive, because you know that the Soviets normally do not put those structures around their reactors, only recently, have done so with the PWR reactors, and it is interesting—the experience with the reactor that was built by the Soviets in Finland: The Finns had to come to the West for help in building the containment structures.

This is why people sometimes—in a funny way—say that they were engineered between Finland and the Soviet Union, using some Westinghouse technology, for what it is called Eastinghouse instead of Westinghouse, and there has been talk that the Soviets were going to approach the Finns for help to transfer the American technology that was incorporated there into the Cuban reactor but, as far as I know, that has not happened, so at this time, the venture in Cuba is strictly Soviet and Cuban, with the participation of all of the satellites—Czechoslovakia supplying something and the East Germans supplying other equipment, and so on—but, as I will say in a moment: The fundamental supply of the reactor will come from the Soviet Union.

As you know, the Soviets have really relied much more upon what they call sound design, of which I have serious doubts, and, in this case, I want to quote a statement by a Mr. Korarsky from years ago.

I do not have exactly the reference, I did not bring with me the reference, but I will read it: "The (Soviet) succcess in the area to atomic powerplant safety has been so great that the selection of locations of powerplants at the present time is not limited by safety requirements—being determined only by technical and economic factors."

I think that this is a very interesting and important statement, which was said some years ago, and I think it is still valid.

In my opinion, and with my limited experience, I do not think safety is of prime importance to them.

For them, I think the prime importance is: How do we put the reactor where we can supply the electricity in the simplest and cheapest possible way, and so on, and, in fact, they have built some of those reactors even within 2 miles from population centers.

Now, at this moment, Cuba is only building two reactors: One that was begun in 1983 and one that was begun in 1985.

When will they be finished?

Well, I think that, no matter how much priority they put on them, I do not see any way that those reactors will be available before 1990, and I do not know how recent that satellite picture was, Senator Hawkins, but it shows that they were laying down only the foundations at that moment—the place where the core will be located.

Now, in terms of the need for this kind of reactor in Cuba—I have serious doubts that, for purely economic reasons, you can justify building four nuclear plants of 440 megawatts each there, at that place, because, if the electric power demand in Cuba had increased since the beginning of the revolution at the 8-percent rate that they said, we could have now—let us say—about 2,000 megawatts, or 2,500, perhaps, but I doubt very much that the demand for electric power in Cuba has increased at that rate, among other things, because the economy has not grown that way, and, too, Cuba was practically all electrified, so there has not been any substantial addition of new people who need to use electricity, and the acquisitive power of the Cuban people is very low, so I cannot understand how, for purely economic reasons, you can justify those reactors; however, there may be other reasons which I will mention briefly.

Now: Why, then, have those reactors in Cuba?

To me, the main reason is that Cuba is a strategic base for the Soviet Union, and it imports about 10 million tons of oil every year, and about 20 percent of that oil to 25 percent of that oil—these are the latest figures that I have from about 3 years ago—goes into the generation of electricity.

Incidentally, if you use that figure and you figure that you need about 2,000 tons of oil per year to generate 1 megawatt—depending upon the efficiency of the plant—I do not see, again, how you can justify that you have now the 2,400 megawatts that they claim.

It is simple elementary arithmetic that shows you that Cuba may have 1,500 or 1,700 megawatts or about. So the two things, in my opinion, do not fit together, unless my information is inadequate and there are other sources of oil that are being imported into Cuba and that are being used to generate electricity, which is a possibility, so I recognize that I may not have all of the information which is required. So, if Cuba is importing that amount of oil, and it depends so much for its lifeline on those tankers coming from the Soviet Union, it is critical for providing the autonomy in electric power generation in Cuba—to have those powerplants—because, as I say in my statement: The core of the nuclear powerplant might last for 1 year, and, if you have one or two spare cores you are covered for about 2 or 3 years. Normally, you have to do that, but we are not now talking in terms of economics as the reasons or incentives; we are talking about strategic requirements.

Well, then it gives a tremendous autonomy, and, in fact, one of those units of 440 megawatts may save Cuba 700,000 tons of oil in a year. So, from that point of view, they are important, and, if you consider that next to the nuclear plant is the nuclear submarine base, then you can see how important it is—not just for the Cuban Government, but for the Soviet Government, also—to assure an adequate supply of electric power there.

Well, having said that, I will indicate—perhaps to bring a little peace of mind to both of the Senators here—that the reactors that are being built in Cuba by the Soviet Union are not just a new type of reactor, but that they have been built for several years—I think for more than 15 or 20 years—and the first ones have been in operation for several years. There are about 45 of that type in the Socialist countries, and they are building now the 1,000 megawatt one, which is not an upgraded system, but one where the reactor is about the same size, but the cooling and the other systems are a little more efficient so that you can upgrade the power.

Incidentally, let me tell you a little anecdote in terms of the business of upgrading the power in Cuba and using the proper technology.

In Cuba, at prerevolutionary times, there were going to be 4 thermal units each of 125 megawatts west of Havana, which had been planned by the Cuban electric power utility, but, of course, the revolution came, and the whole thing came to a standstill, and nothing was done, but, then, shortly after that, the Soviets found out about those plans and said: "Well, it is not a bad idea; let us go on with those 4 units," and they brought in 2 units from the Soviet Union—thermal units—and the two units were installed there, but they forgot one thing: In Cuba the current is 60 hertz, and the current in the Soviet Union is 50 hertz.

They brought the two units, and they discovered that difference too late, so that they decided was: Instead of running the turbines there at 3,000 RPM's—revolutions per minute—which is what you do to generate 50 hertz, they ran them at 360 RPM's, which is just a little faster to generate 60 hertz.

Well, it did not work, and people called those units Queens for a Day, because they fixed them, and they ran for 1 day, and they had to fix them again, and so on, and so on, and so on, but those things happened at the beginning of the revolution, when Soviets did not have too much experience in how to deal with a country which is many thousand miles away, but that gives you an idea of how the Soviets sometimes try to accommodate possibilities to their needs, and I am not saying that in a derogatory way at this moment.

Also, incidentally, I think it is interesting to see that the nuclear powerplant in Cuba is going to be combined with a hydroelectric reservoir in the hills which are not far from Cienfuegos, and they claim that, in this way, the power that they do not need will be used to pump water to that reservoir and that it will be used to generate hydroelectric power of about 300 megawatts.

This is another interesting idea.

Now: What about the safety of the construction and the safety of the operation, and the possibilities of proliferation?

I will finish with this:

The safety of the construction: Nobody can tell you very much about how well the reactor is going to be built and whether they are going to use the right materials, and so on, because you only can do that by inspecting and supervising the project.

I want to quote to you a statement by a Madam Koveleska that was involved in the construction of units 5 and 6 at Chernobyl.

She has criticized the hasty and shoddy construction work and the corruption at Chernobyl—using substandard concrete and less concrete because concrete was diverted elsewhere, and so on.

Also, the Finnish had several problems which are similar to that, so I would say—from a technical point of view—that the Juragua plant should be absolutely reliable, or as reliable as any PWR is, if the construction is done properly, and if the adequate backup systems and redundant systems are included, and so on, and that can be answered only by looking in detail into the plant; however, I have the feeling that the Soviets are going to pay a very special attention to the construction of those nuclear plants in Cuba.

One, there is a tremendous distance between the Soviet Union and Cuba.

Two, they want to make them a showplace.

Three, they need that very badly to have those plants operating in the most reliable way, so I think that they are going to build them with great care.

That is only a personal opinion.

Now: What about the operation of the plants?

Certainly, at this moment, Cuba is training a lot of scientists, and I have met some of them.

Cuba is part of the Joint Institute for Nuclear Research near Moscow, and is part of the Committee on Atomic Energy of the CMEA [the Council for Mutual Economic Assistance].

They are sending people to the so-called international collective of CMEA countries for the physics of VVER reactors in Budapest.

They are sending people to East Germany—to a center for nuclear reactor training in East Germany in Rosendorf—and so on.

They are building small research reactors of 10 megawatts, and so on, so the Cubans really are trying to develop their own manpower, but my suspicion is that the Soviets will maintain a very tight control on those reactors for a few years, or until they have full reliance upon the ability of the Cubans to operate them and, even if they do have full reliance upon the ability of the Cubans to operate them, they still will keep a hand on them for many years.

Now: In terms of proliferation, I do not think that the Cuban reactor program poses any danger of proliferation, because, as you know, the Soviet Union has a takeback policy—that is the Soviets provide their satellites with the reactor core, which is manufactured in the Soviet Union. They manufacture the core, and they put the core in place, and they take it back, and the Cubans will never have a chance to touch it. So, from that point of view, I expect that the Soviets are going to follow the same policy that they have with their other satellites.

Let me now quote another Soviet—a Mr. Penensicoff (phonetic)—when he said in 1980: "Nuclear power development in the CMEA member countries, which is the Council for Mutual Economic Assistance, has led to an arrangement whereby the U.S.S.R. carries out the fuel enrichment, provides to the CMEA member countries the fresh fuel for their nuclear powerplants and takes back the spent fuel for reprocessing, and all of this creates a favorable condition for compliance with the provisions and requirements of the NPT—the Non-Proliferation Treaty."

Incidentally, the Soviets were one of the first sponsors of the NPT together with the United States.

The Soviets require that all of the satellites that have received the 440-megawatt reactors to sign the NPT, but Cuba has refused to sign the NPT for political reasons.

As well, Cuba has not signed the Tlateloico Treaty for the nuclear free zone on Latin America.

The Soviets have found that politically it is good to let Cuba act that way, which gives a feeling that Cuba has an independent policy and also is a sore point against the United States but, on the other hand, the Soviets have requested the Cubans to sign a safeguard agreement with the International Atomic Energy Agency—an agreement which was signed on May 5, 1980.

By that agreement, all of the nuclear facilities in Cuba are under the safeguards of the agency.

Now, I repeat: Safeguards.

Safeguards are not the same as safety.

Safeguards mean that the nuclear fuel will never be diverted for any other use except the generation of electricity, so, from my point of view, I do not think the Cuban reactors pose a major proliferation risk, or any proliferation risk.

Last but not least is: How can we make sure that the nuclear power program in Cuba is done according to international safety arrangements?

Incidentally, I mentioned only the nuclear power program in Cienfuegos, but on paper there are two more—another identical four units planned for the east part of the country and another four units in the west of Cuba near the Mariel region.

Of course, I doubt very much that those plants will be built within the next 20 years or so, although Fidel Castro claims that they will be online by 2010.

I doubt that very much, and I do not think that will happen, but, for propaganda purposes, it is all right, because he can say whatever he likes.

Now: What can we do?

I think there is very little that we can do at this moment, unfortunately, except to try to find out—as Senator Hawkins did by contacting the proper authorities in the Soviet Union and gathering information about what they are doing—the criteria they are using for the construction.

We would never be able to test the concrete to see if the concrete can withstand the pressure, and we would never be able to see if the steel that they are using is the right steel, but at least on paper we may know what they are trying to do.

The second point is: I think we should try to press hard the International Atomic Energy Agency to establish guidelines that can be enforced. They already exist, but they cannot be enforced.

We should try to press hard the international public energy agencies to establish guidelines that all members of the International Atomic Energy Agency should agree to use for any nuclear powerplant they are going to build.

It is not an enforceable—it is not something where we say: "We are going to inspect to see if you are following the guidelines."

Maybe all you need to do is say: "Yes; we agree that these guidelines will be used by my country and, therefore, whenever we are going to build a reactor, we will write to the Agency and tell them that we are following their guidelines," and, then, if something happens, an inspection or an inquiry has to come; it has to be carried out.

I do not see, otherwise, that we can do very much except to hope that nothing goes wrong there and to be prepared here.

Thank you.

Senator COCHRAN. Thank you very much, Doctor Alonso, for your excellent statement, and we appreciate your presentation to the committee in giving us an overview of what is going on in Cuba with regard to the construction of these nuclear reactors and the potential that they pose for danger to the citizens of Florida.

As I understand it, there is not in place any agreement that would permit an inspection of those facilities by any representatives of any international organization; is that correct?

Mr. ALONSO. As I said a moment ago: On May 5, 1980, Cuba signed an agreement with the Agency to place every construction under the safeguards of the Agency, but that refers only to the nuclear powerplants.

That does not give power to the Agency to inspect the mechanical work or the electrical work.

The Agency does not have the power to go and look into that.

The Agency is only supposed to check the in and out flow of unclear material into the reactor and out of the reactor.

Senator COCHRAN. There is no international Agency that is going to have the power to monitor the operation to see that safety procedures are being followed; is that correct?

Mr. ALONSO. The nuclear safety is different from safeguards.

We have to separate safeguards from safety again.

The Agency has a system for the training of people for providing guidelines for the safe operation of reactors, but this is only—as far as I know, again—for the operation.

I had the privilege of being one of the persons who was at the establishment of the Agency at the United Nations many, many years ago—almost about 30 years ago.

No; I think it is exactly 30 years ago.

It was exactly 30 years ago when I was involved in the original Cuban nuclear power program.

We were going to build one reactor with Mitchell Engineering and some other groups, but it never came to fruition, but let me say that I do not think the Agency has any system—and maybe one of the other panels can clarify this—or way of supervising the construction or even the operation.

It is voluntary to say: "Well, yes; I will adopt these safety measures, and I will retrain my people this way, and I will do this, and I will do that," and the only thing that they have that can be enforced is the inspection associated with the safeguards, which, in other words, is the inventory of the fuel—the nuclear fuel: the one that is inside the reactor, the one that is in the pool next to the reactor, the next one that is coming, and so on—and that is the only thing that they can do.

They offer training and technical assistance for anything that you wish, but they cannot come down and say: "This man is not qualified to run this reactor, so send him home and call another one who is."

Senator COCHRAN. Senator Hawkins.

Senator HAWKINS. Dr. Alonso, Americans—and Floridians, especially—have many relatives and friends in Cuba.

Mr. ALONSO. Yes.

Senator HAWKINS. Have your friends in Cuba been educated about these nuclear plants?

Mr. ALONSO. Well, what you saw up there tells you the kind of education they receive there—the typical propaganda of how good it is.

Remember, there is only one source of information in Cuba.

There is no free press, and the only source of information is the government—what comes from the government.

The Cuban people, like the Soviet people, hear only what the Government wants to tell them, and they are telling them how good the reactors that they are building are, and how important they are going to be to the economy, and so on, and the Cuban people do not have any way of finding out what is going on except, for example, Radio Marti, which is a broadcasting system that you have here in Miami for Cuba.

Senator HAWKINS. I know that probably the initial idea of having nuclear power in Cuba was to make them independent—to make the country independent—of imported fuel; however, considering the fact that the Soviets are going to provide the uranium and the hardware, as well as the supervisors, will the reactors not really increase the dependence of the Cubans upon the Soviet Union?

Mr. ALONSO. Would you say that again?

Senator HAWKINS. Since the Soviets are going to provide the hardware—the uranium and the training—will this not really increase the Cubans' dependence upon the Soviet Union?

Mr. ALONSO. One hundred percent; yes.

Cuba is going to be totally dependent.

First, for the construction, Cuba does not have the means to building the plant and, in fact, capital of about $2 billion is required for building the first two units, or the estimate that is coming out on it and, then, for the operation and the future fuel, it all has to come from the Soviet Union, so it is total dependence, and that is why I doubt very much that the initiative came from the Cuban Government.

You see, the agreement between Cuba and the Soviet Union for building the nuclear powerplant was signed in 1976, so this project comes from way back—from 10 years back—and the construction only began in 1983 and 1985 because the study was not completed until 1979, or something, and it took a long time for the Soviets to decide where it was going to be built, and so on, so it was not just a recent decision, but, in my opinion, it all comes from them, and I think that the blockade that took place at the time of the missile crisis is what opened the eyes of the Soviets and made them see how fragile the fuel connection between the Soviet Union and Cuba was, and it was at that very minute that they began to think about what they could do to make that in Cuba there was never going to

be a lack of electric power—at least for military purposes and for other purposes.

Senator HAWKINS. Thank you.

Senator COCHRAN. Thank you so much for being our lead-off witness and for helping us to understand the character of the situation there and program that is planned in Cuba by the Soviet Union.

Your prepared statement will be included in the record.

We now have a panel of witnesses representing several Government agencies from Washington, and we would invite each member of the panel to come forward.

The panel includes Mr. Richard Vollmer, who is the Deputy Director for the Office of Nuclear Reactor Regulation at the U.S. Nuclear Regulatory Commission; Dr. Delbert Bunch, Acting Deputy Assistant Secretary for Reactor Deployment at the U.S. Department of Energy; Dr. Lester Machta, Director of the Air Resources Laboratory of the National Oceanic and Atmospheric Administration; Mr. Allen Sessoms, who is the Director of Nuclear Technology and Safeguards at the U.S. Department of State.

We appreciate your being here, and we welcome you to the hearing. We have copies of the statements which you have prepared for the committee, and we thank you for those.

At this point, we are going to incorporate those statements in the record in full, but we would also encourage you to make summary comments from those written statements so that we will have an opportunity for discussion of the issues that are involved.

Senator COCHRAN. Let us begin with Mr. Vollmer, please.

TESTIMONY OF RICHARD H. VOLLMER,[1] DEPUTY DIRECTOR OF THE OFFICE OF NUCLEAR REACTOR REGULATION, U.S. NUCLEAR REGULATORY COMMISSION; DELBERT F. BUNCH,[2] ACTING DEPUTY ASSISTANT SECRETARY FOR REACTOR DEPLOYMENT, U.S. DEPARTMENT OF ENERGY; LESTER MACHTA,[3] DIRECTOR OF THE AIR RESOURCES LABORATORY, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; AND ALLEN LEE SESSOMS,[4] DIRECTOR OF NUCLEAR TECHNOLOGY AND SAFEGUARDS, U.S. DEPARTMENT OF STATE

Mr. VOLLMER. Thank you, Mr. Chairman, and it is a pleasure to appear before you today to discuss the role of the Nuclear Regulatory Commission—the NRC—in the regulation of nuclear power plants and the protection of public health and safety.

I might indicate very briefly how the NRC performs the licensing process for plants in the United States.

We do an extensive review of the design of nuclear powerplants to assure a number of things.

First of all, we do a review to assure that the systems, the buildings and the components are all designed and constructed so that there will be a high likelihood of safe and trouble-free operation.

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[1] See p. 40 for Mr. Vollmer's prepared statement.
[2] See p. 46 for Mr. Bunch's prepared statement with attachments.
[3] See p. 60 Mr. Machta's prepared statement with attachments.
[4] See p. 80 Mr. Sessoms' prepared statement.

We also do a review to assure that many possible failures are considered in the design of a plant, and that systems are provided to assure that—should these failures occur—there is backup equipment and systems to take care of the consequences of any possible failure.

Finally, we do a review to assure that—even if all of these systems and backup systems do fail—there are features such as a containment system, and strong leak-tight buildings, which would provide a high degree of assurance that, if all else were to fail, the public would still be protected against the release of radioactive materials.

We also require a fair number of—I will call them—nonhardware associated features in these plants, and the two perhaps most important things are that there be a highly qualified and tested staff of people to operate and maintain the plant during its period of operation, and, second, that there be a very effective emergency planning system in place, and tested, so that, again—in the event of an unlikely release of radioactive materials—the utility licensee would have within his system a trained and experienced cadre of people who would assess the situation and notify Federal, State and local officials, and, if need be, put into effect an emergency response system to provide for protection against the general public, or for protection for the general public.

The principal features of these emergency preparedness programs—I will list those, since they are perhaps important to the considerations that you have before you.

First of all, we require that there be detailed plans for the protective measures of the public—for two types of radii around the plant.

One is about 10 miles in radius, which we consider the—obviously, it is the most closein and the most at-risk population.

Another is about 50 miles around the plant, which we call the sheltering and evacuation from exposure, and in which we would insure that there would be the control of milk products and other food stocks.

Again, these emergency plans are in effect to assure that—if an accident should occur—the appropriate effective measures would be taken either by evacuating people close into the site or by asking them to stay inside, or by providing sheltering, which may be a very worthwhile form of protection.

In the farther reaches from the plant—about 50 miles—we consider the possibility of perhaps interdiction in the event of an accident by providing for the control of food stocks, milk, vegetables, water, and so on.

I think the combination of a great deal of attention to the design and construction of the plant, and looking toward possible accidents and ways that they can be prevented, and assuring that the opperation's personnel are tested to be sure that they know the plant and can operate the plant very well, and by putting the final measure of protection in and the potential emergency planning in case there is an accident—this sort of is the ground—this is sort of the envelope of protection we look for in providing licenses for our nuclear powerplants in the United States.

That, Mr. Chairman, is a summary statement of what I have presented for the record.

Senator COCHRAN. Thank you, Mr. Vollmer, for discussing the factors which are used by the Nuclear Regulatory Commission to detemine whether plants are safe enough to be licensed.

Dr. Bunch, we will hear from you now.

We are interested in hearing from you about the Cuban reactors, with special attention to the safety considerations such as containment.

Mr. BUNCH. Thank you, Mr. Chairman, and I will, indeed, try to summarize the description of the Soviet-designed Cuban reactors.

My prepared testimony does contain a summary of what we know about those reactors, and it is based upon a review of the Soviet literature and our discussions with those who have hands-on experience with the construction and operation of the Soviet-designed pressurized water reactors.

There are presently 41 of that particular type of reactor in operation or under construction in Soviet bloc countries, Finland, and now Cuba.

I would note that the Soviets, over time, have attempted to upgrade the safety of their power reactors—particularly on their new export models, of which Cuban reactors are one example.

These stringent safety practices, no doubt, have had some impact upon the Soviet-designed export model now being constructed in Cuba.

I think that it would be useful to emphasize again, as has been done, that there are differences, between the Cuban reactors and the Chernobyl reactors.

On the most basic levels, the Cuban reactors have several important safety characteristics.

First, as in the case of all U.S. reactors, the Soviet-designed 440-megawatt electric reactors have an overall negative temperature and power coefficient.

That simply means that the reactor tends to be self-correcting in the event of an equipment or operator malfunction.

Second, that particular design has a very large quantity of water in the primary system—in the piping that cools the water that cools the core—and that means that abundant water is available in the event of an equipment malfunction in order to keep the reactor cool.

The Cuban reactors are reportedly equipped with some special features, such as additional protection against earthquakes, as was mentioned this morning, and materials appropriate for a tropical climate.

Whether or not there have been other special features included in that machine is hard to tell at this point in time.

Certainly, I think Cuba—as a member of the International Atomic Energy Agency—will be following the reports on Chernobyl and may wish to make additional improvements in either the design or the operational practices before the reactors actually go into operation.

I noticed that Senator Hawkins had a satellite shot of the site, itself, and, if you would like—at the conclusion of the panel or

right now—I would be pleased to try to point out some of its features.

Senator COCHRAN. I think we would like to see those features described by you now, if we could do that.

Mr. BUNCH. Certainly.

I believe that this is a picture out of a Cuban magazine called Bohemia, and what you are seeing here is a model or a sketch of what the reactor will look like when it is constructed.

These are the two units of the powerplant itself, and this is where the reactor is—reactor one and reactor two.

Inside the containment building is the reactor core and a water system to take heat from the core and to transport the heat to what is called the steam generator.

The water is coming from a separate source into the steam generator, and it turns into steam and goes to a turbine building.

This looks to me to be the turbine building here.

The hot steam is used to drive the turbines and to create electricity, and then the electricity goes out to what looks to me to be the switchyard right here, and then it goes into the port city of Cienfuegos.

This particular reactor—or the reactor in the picture—looks to be laid our the same as the Loviisa design in Finland.

This is a control building where the operators would actually run the plant, and this is a stack that is used to discharge routine radioactivity releases.

The experiences that we have had—or that we have seen in the Soviet reactors—are that their releases are relatively small.

This is the pump house, but I do not know if you can see the four circulating water pumps. They are actually very large pumps here, and then there are four more on the other side.

The water would come in from the bay and be pumped into here, and then I believe that it would be taken over to underneath here, and then be taken over to the turbine building that is used for this indirect machine cycle.

These look like chemical tanks here, and here, so this would be the chemical treatment system to keep the water pure and clean.

This is probably the administrative building over here.

This is the rough layout of the plant, which is a traditional pressurized water reactor.

Senator COCHRAN. Thank you very much, Dr. Bunch.

Mr. BUNCH. There are another——

Senator COCHRAN [interjecting]. The other photograph, I think, was of the actual construction.

Senator HAWKINS. Can you tell us how far along you feel that it actually is?

Mr. BUNCH. Yes, ma'am; although I think it is difficult to get much detail from this particular chart——

Senator HAWKINS. It is the best we can do.

Mr. BUNCH [continuing]. If you will notice, there are two striking aspects of this, the principal of which is the two large cylindrical areas here.

This would be unit 1, and this would be unit 2.

The typical Soviet-designed 400-megawatt class pressurized water reactor has a rectangular configuration, because they do not have containments of the U.S. style.

You see here cylinders in cylinders very much like the Loviisa, Finland, plant and corresponding to some of the Soviet plants in the early 1980's.

I would conclude that, in fact, these are Western-style containments, which are consistent with the pictures that you just saw.

If this is a 1985-86 satellite photograph, it would show that this is still in a very early stage of construction—probably at least 4 years, and perhaps more, away from the operation of the first unit.

The containment is just now under construction, and this would be the control building, and they are just now working on the fundamental foundations.

These look like the footings that would hold the switch gear, so the construction is just barely underway.

Senator COCHRAN. Thank you very much, Dr. Bunch.

Let us move now to hear from Dr. Lester Machta, who is the director of Air Resources Laboratory at the National Oceanic and Atmospheric Administration, and who will discuss the likely meteorological impact of any potential nuclear accident on the surrounding areas—such as Florida.

Mr. MACHTA. Thank you, Mr. Chairman.

I would like to address the question of air flow from Cienfuegos, Cuba, to various locations—the Gulf of Mexico, the Caribbean, Central America, and particularly the Southeastern United States.

The first exhibit that you see here shows a map with trajectories that originate from a powerplant that is proposed at Cienfuegos.

These trajectories trace the flow of the centerline of the air—or the air containing radioactivity if any were released.

The altitudes chosen for the calculations—near sea level, which is the solid line, and at 5,000 feet, which is the dashed line—were selected because, in our estimation, they are the most relevant to radioactive release from a nuclear powerplant, and because they are the standard levels in the atmosphere where weather data are normally available.

Both trajectories start on January 1, 1985, and the numbers along each trajectory indicate daily—or the 24-hour—positions after start, and you can note that the paths differ.

Had we run trajectories at levels between the two shown on this exhibit, they would likely lie somewhere in between.

In addition to transport along the trajectory paths, a mass of air would spread horizontally with time so that, after 2 days of travel, it might have a radius of maybe 100 miles or so around the 2-day point on the centerline shown on the exhibit.

Trajectories calculated in a similar fashion are used for exhibit 2, where we have run trajectories twice a day for 2 years.

It shows the probability of any point in the gulf, the Caribbean, Central America, or the Southeastern United States being overridden by air which initially started from Cienfuegos.

This picture presents the annual average probability derived from all weather patterns in 1984, and the picture in 1985 is not very much different.

One could interpret exhibit 2 as follows:

If radioactivity were constantly emitted from Cienfuegos, the numbers would reflect the percentage of the time that air containing radioactivity would pass over an area, or, viewed in another way, the percentage of the time a monitoring station in the area would detect radioactivity in the air or, if it rained, in the rainwater.

For example, the radioactivity could be expected over southern Florida about 25 percent of the time.

In 1985 the number ran a little bit higher, or a little over 30 percent of the time.

When applying these probabilities, I emphasize that—for any actual single nuclear accident—the radioactivity would take one specific path, based upon the air flow at that time, and would, therefore, hit or miss southern Florida.

The fourth exhibit shows the average time that it takes for the air from Cienfuegos to reach an area on the map; thus, on those times when the air moves to southern Florida, it will take an average of about 2 to 3 days.

Exhibit 5 shows the shortest travel time to an area from Cienfuegos.

For southern Florida, for example, the shortest time is less than 1 day's travel, rather than the average of 2 to 3 days.

An earlier arrival, with less horizontal spread, allows greater dry deposition, or wet deposition if rain is encountered, and less radioactive decay.

In this statement, Mr. Chairman, there have been no estimates of the amount of radioactivity or hazards to the people or to the environment.

These estimates lie outside the area of expertise of my agency, NOAA.

NOAA will advise when and where radioactivity injected into the atmosphere might reach sensitive areas so that appropriate monitoring or other steps can be taken.

Thank you very much.

Senator COCHRAN. Thank you; thank you very much, Dr. Machta, for that presentation.

We now would like to hear from Mr. Allen Lee Sessoms, from the Department of State—the director of Nuclear Technology and Safeguards—to talk about our Government's efforts to work with the International Atomic Energy Agency and other nations to insure nuclear safety in Cuba and elsewhere.

Mr. Sessoms.

Mr. SESSOMS. Thank you, Mr. Chairman, and I am pleased to have this opportunity to testify here today regarding the Soviet-supplied nuclear power reactors under construction at Juragua, in Cienfuegos, Cuba.

The Department of State has discussed with Soviet representatives our interest in learning more of the planned safety features of the Cuban reactors.

The Soviets responded positively, and we have agreed to put this subject on the agenda of a United States-Soviet bilateral meeting on nuclear matters.

This meeting is scheduled for late July in Moscow, and we plan at that time to query the Soviets on specific safety features which

relate to oceanside sites, tropical weather conditions, and the structural design of the container.

In the wake of the Chernobyl disaster, the Soviets have been forthcoming in discussions on safety issues, so we believe that our conversations will be useful.

The Cubans have said that a series of containments structures are planned for their reactors, and this was discussed by Dr. Bunch in this presentation.

They have also said that the plant is designed to withstand earthquakes and hurricanes.

A Cuban official described the system as consisting of fuel casings, a sealed primary circuit, and an enclosure for all systems and components of the primary circuit, and we intend to pursue the details of these statements.

The interest section in Havana is also seeking information regarding the reactors.

We are making known our concern that the reactors incorporate the best possible safety features in both construction and operation.

We have discussed these safety features and issues with other nations of the region, and we believe that they share our legitimate interest in this particular subject.

There is already a broad consensus that for each country the maintenance of safety and security of nuclear energy is an international responsibility, and not merely a national one.

Each country engaged in nuclear power generation bears the full responsibility for the safety of the design, manufacture, operation, and maintenance of its installations.

In early May, while the events at Chernobyl were still unfolding, the United States—together with a number of its allies—called for a special meeting of the International Atomic Energy Agency's Board of Governors to consider measures to strengthen international cooperation in nucelar safety.

The special board meeting convened on May 21, and the delegations—including, significantly, that of the Soviet Union—were unanimous in calling for urgent IAEA actions to develop international rules for the early notification of nuclear accidents and for an emergency response mechanism.

Specifically, the special board authorized the Agency's Director General, Hans Blix, to prepare a set of detailed proposals for agency action, and these were approved at the regular board meeting in June.

The work program thus established includes the following:

First, a meeting of experts during the last week of August to review the Chernobyl accident, and the presentation will be made by Soviet experts.

Second, beginning on July 21, a group of experts will draft—on an urgent basis—two international agreements: One to provide for the early notification of nuclear accidents with possible transboundary effects and the dissemination of comprehensive information concerning them, and the other to provide a framework to facilitate international assistance, including emergency response measures, in the event of such accidents.

Third, the IAEA's work program calls for a group of experts to consider, over a longer period, additional measures to improve co-

operation in the field of nuclear safety, including further refinement of nuclear safety standards, and this group will convene in November.

Fourth, it calls for an international conference, under IAEA auspices, to review the full range of nuclear safety matters, including recommendations emerging from the various expert groups and from the IAEA Secretariat, and a special session of the General Conference of the IAEA will be held from September 24 through 26 in Vienna, Austria, for the purpose of addressing those issues.

The United States has also made it known in the IAEA—of which Cuba is a member—our interest in the safety questions at Cienfuegos.

The IAEA sponsors onsite safety reviews conducted by so-called operational safety review teams, and these teams are usually composed of an international staff of 10 to 15 reactor safety experts, and they usually take 2 to 3 weeks to complete safety assessments of operating reactors.

Although these teams are not normally sent to reactors still under construction, they have on occasion been made available to countries which wish a review during the construction stage on safety procedures.

Both Mexico and the Philippines have, for example, requested and received the assistance of such teams.

We support such reviews and other IAEA safety and technical assessments of which the Cubans might wish to avail themsleves.

In addition to the IAEA, there are other international bodies that play an important role in international nuclear safety efforts, and one such is the Nuclear Energy Agency of the Organization for Economic Cooperation and Development, which is headquartered in Paris.

The United States has been an active participant in the Nuclear Energy Agency and will continue to be one, and it was a U.S. urging, for example, that the Nuclear Energy Agency's Committee on the Safety of Nuclear Installations convened on May 9 of this year to review the earliest data concerning the Chernobyl accident.

Likewise, another NEA committee—the Committee on Radiation Protection and Public Health—is scheduled to meet to discuss the Chernobyl accident in special session on September 1 and 2.

In the specific case of Cuba, I can assure you—for the Department of State—that the U.S. Government is seeking complete information on those reactors which are under construction and will urge Cuba and the Soviet Union to assure that they meet the most exacting safety standards.

Thank you, Mr. Chairman.

Senator COCHRAN. Thank you, Mr. Sessoms.

This has been an excellent panel, I think, to give us a broad general view and some specific information about what is going on in Cuba and what impact their participation in international organizations may have.

One thing that concerns me is that Cuba has not signed the Nonproliferation Treaty, and we worry that this may mean that there will not be the degree of cooperation with international organizations in these areas that we might want to expect—particularly in view of the testimony that we have heard: That an accident

could—due to certain meteorological conditions—mean that radioactive particles could be carried into the U.S. area, and particularly into southern Florida.

What impact does the failure or refusal of Cuba to sign these international agreements have in the judgment of the panel?

Should we be concerned about that, Mr. Sessoms?

Mr. SESSOMS. Thank you, Mr. Chairman, and we are concerned when any country does not sign any nonproliferation treaty, and we have urged—as have the Soviets—that Cuba should sign those treaties.

We have seen, however, that—in the context of the IAEA—the Cubans have shown particular interest in the safety of nuclear installations and have been very active in arranging for meetings and participating in the process toward the convening of an experts group to negotiate the conventions that I mentioned; therefore, we believe that the Cubans are actively interested in the safety of any nuclear powerplant constructed on Cuban soil and will be actively engaged in the IAEA to try to assure—as far as they can—that those reactors meet the exacting standards.

Senator COCHRAN. I think it is encouraging that some progress is being made in Vienna at the International Atomic Energy Agency to develop a convention, or at least to discuss the development of a convention and an agreement amongst nations, and possibly to expand the work to include nuclear safety.

This is something, I think, that we should closely monitor, and it may be that we will reach that point where nations can agree to have international representatives of agencies such as the IAEA make onsite inspections at locations such as a Cienfuegos, in order to satisfy the concerns that members of the international community have on nuclear safety.

It is not just nuclear proliferation and the safeguards now that are the only concerns.

We have learned from Chernobyl that there are other concerns, as well, and that there may be an appropriate international effort that can be developed to have onsite inspections to guarantee nuclear safety.

Senator Hawkins.

Senator HAWKINS. Thank you, Mr. Chairman.

Dr. Bunch, is it really possible to change the design and construction of a container structure midway through construction?

I was the public service commissioner here in the State of Florida for many, many years, and I have sat through many, many, many hearings on nuclear powerplants, and it just boggles my mind, and what I mentioned to Senator Cochran—whose brother is a public service commissioner in Mississippi—is: Is it really possible to change the design midway through construction, such as we saw on the tape, which is recent—January 1986?

They are busy building this, and they are right in the middle of it.

Mr. BUNCH. I think the short answer is: "Yes," and, in fact, Mr. Vollmer may wish to comment further, but, in the history of the U.S. power industry there have been many, many changes to both containment systems and to other systems as we learned more or as there were deficiencies identified.

The plant in Cuba is not well along in its construction, and there are still plenty of opportunities for modifications.

In terms of what you are dealing with—and what I was trying to describe today: You are starting with a concept which has a containment, so you are not talking about backfitting a plant which is already built and which has no containment at all, which would, in fact, be pretty costly, but there may be details about piping the pumps and valves which would improve its capability to withstand accidents, and, in that area, specifically, there are opportunities to make further improvements.

Senator HAWKINS. In your written testimony, you indicate that the Cuban reactors will have some of the United States safety features, but not all of them, so, in your opinion, what will be missing?

Mr. BUNCH. As I understand the design of those reactors, they are such that they have redundant ways of bringing cooling water into the reactor core in the event that they have pipe breaks.

The system's design looks very capable from that standpoint.

One of the lessons learned in the U.S. plants in the seventies was: In areas such as fire protection—where you might have a weakness in the design, if I might call it that, where a single large fire might wipe out a whole host of safety systems—it may well be that the Soviet design of this particular machine does not have the fire protection capabilities that we see in the United States plants.

As an example, there may be a lack of redundancy of some of the valves so that you do not have the kind of resistance to some kinds of failures that we would expect to see in U.S. plants.

Senator HAWKINS. Mr. Vollmer, to follow up on what Dr. Bunch said, would you license a plant without these safety features?

Mr. VOLLMER. Well, as Dr. Bunch indicated, we would not license it without the safety features that we currently require in the regulations; however, I cannot discern how lacking the Cienfuegos plant would be in that particular regard.

As was indicated, it is likely that many of the basic safety features are, in fact, in place—such as emergency cooling, containment and so on—but, as we have gotten more sophisticated and learned more here and abroad through many, many reactor years of operation, it is attention to the more detailed parts of the design's construction and operation, such as we have found at the Three Mile Island accident where the accident initiated in a part of the plant remote from the primary system that we——

Those lessons we have learned well in this country, and we have done a great deal of upgrading on our plants.

Whether or not the Soviet design has incorporated these features, I certainly cannot tell, but, in this country, we would not license a plant until they are incorporated.

Senator HAWKINS. How to you determine risks?

Mr. VOLLMER. We determine risks by evaluating the possibility or likelihood of various types of accidents, and then following that accident out to its course and evaluating the consequences of the accident, and the combination of that would give you a reading of the risks that would be associated with the operation.

The risk might be that there is a possibility of one in a million, for example, that somebody living around the reactor would receive a radiation exposure at a certain level in the lifetime of the plant.

It is a combination of the possibility of an accident times the consequences that might occur.

Senator HAWKINS. Dr. Bunch, hurricanes are very common around the Cienfuegos area.

Are those reactors vulnerable to hurricanes.

Mr. BUNCH. I really have no way of knowing that. The plant site is on the bay, rather than on the open ocean, and it does have what appears to be a reinforced concrete containment.

Senator HAWKINS. In terms of how much protection is actually there——

Mr. BUNCH. That would require an analysis which we do not have at this point in time.

Senator HAWKINS. Dr. Machta, what are the prevailing wind patterns from Cuba toward the State of Florida?

Mr. MACHTA. They generally will go westward and then recurve toward the northeast.

That would be the average case.

On rare occasions, one can have winds which blow directly toward the northwest, which would be from Cienfuegos toward the lower Florida peninsula.

Senator HAWKINS. Would radioactive debris reach Florida in hazardous concentrations?

Mr. MACHTA. That would depend upon the amount of material that would be released, so I really cannot answer that question without knowing the amount being released.

Senator HAWKINS. Given Florida's high water table during the hurricane season, would Florida be more vulnerable than other areas?

Mr. MACHTA. Well, again, it would depend upon the amount of deposited radioactivity, and there is a possibility, but, really, I am not in a position to comment on that.

Senator HAWKINS. I am really fascinated by some of the answers: "We do not know," and: "We may never know until after an accident," in light of the fact on the record that we did not know anything about the Soviet accident until Sweden picked it up on their own detection equipment 700 miles away, and that continues to ring through my mind as we continue to talk about: "What if?"

Dr. Machta, has no one ever detected any other types of airborne pollution from Cuba?

Mr. MACHTA. Not that I am ever aware of; no.

Senator HAWKINS. Would you research that for us and provide us with——

Mr. MACHTA [interjecting]. We have actually looked at it, and as far as we can tell, we have never found any, and we are not aware of any.

Senator HAWKINS. All right; thank you very much, but I am concerned about the fact that we meet and plan after the accident, and it seems to me that—in light of Chernobyl accident—we should learn an awful lot and apply tremendous public pressure.

I see countries opening embassies now in Cuba, in light of Castro's new philosophy toward Latin America, and yet he refused to sign the treaty which prevents nuclear proliferation in Latin

America, and it seems to me that the Department of State could get tough and bring plenty of pressure on the countries that do recognize Cuba and that are much closer to Cuba than the United States, and that we could have some success at the next retreat meeting that you all have.

Senator COCHRAN. Thank you very much.

Senator HAWKINS. I have something that I would like to submit for the record.

Senator COCHRAN. In connection with those questions that were submitted: We hope that you will be able to respond in a timely fashion so that the answers may be included in the record.

Thank you so much for being a part of our hearing today; you have added greatly to it, and we appreciate your cooperation with our subcommittee.

Our final witness for our hearing is Mr. Robert G. Nave, who is the assistant director of the Division of Emergency Management of the Florida Department of Community Affairs.

Mr. Nave has been asked to provide the subcommittee with information about the ability, organization, and experience of the State of Florida to deal with emergencies such as nuclear accidents.

Mr. Nave, we appreciate your being here and providing us with the statement which you have prepared.

We encourage you to make any summary comments or to highlight that statement in any way that you choose.

TESTIMONY OF ROBERT G. NAVE,[1] ASSISTANT DIRECTOR OF THE DIVISION OF EMERGENCY MANAGEMENT OF THE FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS

Mr. NAVE. Thank you, Mr. Chairman.

State and local governments in Florida have been working for several years now to develop and implement a comprehensive emergency management program in Florida—meaning that plans are developed to deal with a wide range of natural and technological hazards.

State and local governments routinely develop emergency plans, and those plans are evaluated through periodic exercises, and emergency response personnel and public officials are trained in the implementation of those plans, and the public is educated with regard to the different hazards to which they might be subjected.

I think you can get a pretty good overall picture of Florida's emergency management capabilities by looking back at the 1985 hurricane season and the fact that we were able to evacuate approximately 1 to 1½ million persons without any serious incidents during Hurricanes Elena and Kate.

With regard to radiological emergencies, there are three programs in Florida that could be used—and that would be used—to deal with nuclear powerplant accidents.

The first is the state of radiological emergency response program—the radiological emergency preparedness program—which is run by the department of community affairs.

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[1] See p. 91 for Mr. Nave's prepared statement.

This program was developed and implemented in response to the Three Mile Island accident and the subsequent Federal planning preparedness requirements.

In that program, we have developed what we call the Florida Radiological Emergency Management Plan for Nuclear Powerplants, but I will just call it the radiological emergency plan.

That plan addresses all of the planning criteria and standards addressed in the NUREG-0654 and it complies with section 252.60 of the Florida statutes.

That plan outlines actions to be taken by State and local governments and by the nuclear powerplant operators in the event of an emergency to assure the health and safety of the public.

The plan addresses two planning zones, as Mr. Vollmer mentioned briefly this morning.

The first one is the plume exposure pathway, which includes a radius of approximately 10 miles around each nuclear plant.

In Florida there are more than 220,000 persons living in six counties that are within 10 miles of commercial nuclear plants, and, because of that, they are subject to whole-body exposure or the inhalation of gamma radiation if it were released from those plants.

The emergency plans for that zone include things like the evacuation and sheltering of those people, and also the sheltering "in-place" of those people if evacuation were not feasible.

The second planning zone extends outward to a radius of approximately 50 miles from each plant, and that is called the ingestion explosure pathway, and the major concern there would be the ingestion of contaminated food or water or milk products, or things like that, so our emergency plans for that area deal primarily with the interdiction of contaminated food, water, and milk products.

The plan also addresses coordination between State, local and Federal governments on the licensees, and it outlines the procedures for assessing the accident and determining the consequences of that accident, and for the development of protective action recommendations.

Florida has been very fortunate to receive national recognition in this program area.

In February 1984, Florida received approval of its State radiological emergency plan, thus becoming only the fifth State to have its plan approved, and I believe the first State to have all of its site plans approved at the same time, and that is something that we are very proud of.

In March 1984, the State, Martin and Saint Lucie Counties, and the Florida Power & Light Co. hosted the first exercise of the Federal radiological emergency plan in what was called the Federal field exercise.

That was a 3-day exercise.

The first day looked at the evaluation of the State and local plans.

The second and third days dealt with the evaluation of the Federal plan and Federal response capabilities.

The one thing that this exercise allowed the State of Florida to do was to interact with the Federal Government in a simulated reactor accident, and it gave us a very good chance to practice coordi-

nation with the Federal agencies to see the personnel, equipment and laboratory support capabilities of the Federal Government in a simulated scenario.

Because of that, we have a very unique perspective on nuclear power plant emergencies in Florida.

Another program that would be used is the radiological protection program, which is also administered by the department of community affairs.

It is a 100-percent federally funded program, and the funds are used to train State and local radiological monitors, and to train people in how to use the monitoring equipment and how to conduct field monitoring activities, and it also allows us to maintain an inventory of approximately 71,000 radiological monitoring devices—most of which are located in the counties where they are used in radiological emergencies.

The third program is not an emergency program, but it is the State department of health and rehabilitative services' environmental surveillance program.

The department of health and rehabilitative services has monitoring stations located in cities throughout the State, and there are also monitoring stations located around each one of the nuclear facilities.

Those facilities collect airborne and precipitant samples, and those samples are analyzed on a weekly basis, and, if there were any increased levels of radioactivity, they would be detected through that program, as well.

After the Chernobyl emergency, the State activated a number of those monitoring stations—three of which had been deactivated after the Chinese nuclear testing program from 1976 to 1980—and the frequency of testing those samples was increased from weekly to daily, so, at least six stations throughout the State, there were daily airborne and precipitant samples taken, collected, and analyzed after that emergency.

In addition to that, precautionary milk samples were taken statewide to see if there were any increased radiation levels, and there was a ship that had been in the Kiev harbor at the time of that emergency—a ship that was on its way to Jacksonville—and, upon arrival in Jacksonville, that ship was monitored, and small levels of contamination were found on both the ship and the crew.

Those three programs would be used primarily in the event of emergency at the Cuban reactor.

In closing, I would like to say that—although we do not have plans specific to that reactor—I am confident that the State does have the capability to protect—and will protect—the health and safety of the public if that were to occur.

Thank you very much.

Senator COCHRAN. Thank you, Mr. Nave, and let me ask you this:

You talked about coordinating your efforts with Federal agencies in past exercises.

Do you feel that you get the degree of cooperation from Federal agencies that you wish in trying to prepare for a disaster that would threaten the health and safety of the citizens of Florida?

Mr. NAVE. Yes, sir; I think we were very pleased and surprised with the level of coordination, and we had the opportunity—before

the Federal field exercise—to do a tabletop simulation of that plan, and, also, what we call a practice exercise, and those efforts helped to identify problem areas and some areas in which increased coordination would be needed, and some procedural changes that needed to be made, and, as a result of that, the actual exercise went very well from the coordination standpoint.

Senator COCHRAN. Do you think that—based upon your experience in preparing for and dealing with nuclear power-related accidents in the State of Florida, and the procedures that you have developed in field exercises—you would be prepared to deal with an emergency caused by a nuclear accident in Cuba?

Mr. NAVE. Yes, sir; we do have the capability, equipment and trained personnel, and, with the assistance with the Federal Government's resources that we saw at the Federal field exercise, I am pretty confident that we could deal with that emergency.

Senator COCHRAN. Senator Hawkins.

Senator HAWKINS. How would you expect to be notified if an accident should occur in the Cienfuegos nuclear powerplant?

Mr. NAVE. I would think that it would be in one of two ways.

One would be through normal governmental channels.

If the Cuban Government were to notify the State Department, for example, the State Department would then more than likely notify the NRC, which would then notify the State, and we would then take appropriate actions.

In the absence of normal notification procedures, we would expect to see increased levels of radiation at the environmental monitoring stations, and we might be in a posture where we would be notified the same way that the Swedish Government was.

Senator HAWKINS. How far south are the detection facilities?

Mr. NAVE. There are regular environmental monitoring stations in Miami, and then there are a number of additional stations located around the Turkey Point nuclear plant.

Senator HAWKINS. Are there any in Key West?

Mr. NAVE. I am not sure, but I do not believe that there are any in Key West.

Senator HAWKINS. Will you find out for us?

Mr. NAVE. Yes, ma'am; I will.

Senator HAWKINS. Thank you very much.

Mr. NAVE. You are welcome.

[The information referred to follows:]

STATE OF FLORIDA
DEPARTMENT OF COMMUNITY AFFAIRS

2571 EXECUTIVE CENTER CIRCLE, EAST • TALLAHASSEE, FLORIDA 32301

BOB GRAHAM
Governor

TOM LEWIS, JR.
Secretary

July 17, 1986

Mr. Robert McArthur
United States Senate Committee
on Governmental Affairs
Subcommittee on Energy, Nuclear
Proliferation and Governmental
Processes
Room 605
Washington, D. C. 20510

Dear Mr. McArthur:

At the June 30 subcommittee hearing in Miami, Senator Hawkins asked whether the State maintained and operated a radiological monitoring station in Key West. The Florida Department of Health and Rehabilitative Services (DHRS) Office of Radiation Control has confirmed that there are no radiological monitoring stations in Key West. I have advised the DHRS of the Senator's concern. We agree that, based upon the recent experience at Chernobyl, state and federal agencies need to reevaluate their radiological monitoring capabilities and to enhance those capabilities as appropriate to ensure the health and safety of the public.

We will pursue this issue with the appropriate federal agencies as the Cienfuegos reactors near completion. If you have further questions, please call me at the Department of Community Affairs, Division of Emergency Management, 1720 South Gadsden Street, Tallahassee, Florida 32301, (904) 487-4918.

Sincerely,

Robert G. Nave

Robert G. Nave
Assistant Director
Division of Emergency
Management

Senator COCHRAN. Thank you, Mr. Nave, for your participation in our hearing, and let me thank all of the witnesses for their excellent presentations this morning to our subcommittee.

I think we are certainly better able now to assess the potential for risk and danger to the citizens of the United States, and particularly here in the State of Florida by reason of the construction of these nuclear power reactors in Cuba.

I think we have learned that extra efforts ought to be made to try to get signatures on treaties that apply in situations relating to non-proliferation and to nuclear plant inspection.

I hope that the meetings that are planned for the balance of the summer in Vienna by the International Atomic Energy Agency will take up the possibility for enlarging the scope and authority of the IAEA to include onsite inspections to help insure that nuclear safety standards are recognized and complied with in the construction of nuclear plants worldwide.

This is a matter which is being discussed and which is under consideration, and I hope that our Federal officials will use their best efforts to push forward in that direction.

I want to think again Senator Hawkins for bringing this entire matter to the attention of the United States Senate and our Government, and I want to put in the record a copy of the letter that she wrote to Mikhail Gorbachev in April, following the accident that occurred at the Chernobyl nuclear powerplant, discussing the facilities that were being planned and constructed near the town of Cienfuegos,

[The letter referred to follows:]

64-410 O—86——2

PAULA HAWKINS
FLORIDA

United States Senate

WASHINGTON, DC 20510

April 30, 1986

His Excellency
Mikhail S. Gorbachev
General Secretary
Central Committee of the
Communist Party
The Kremlin
Moscow, USSR

Dear Mr. Secretary:

I extend my regrets to the people of the Soviet Union who have been killed or injured as a result of the accident at the Chernobyl nuclear power plant and hope that the damage caused by this accident will prove to be limited. I am sure, however, that you share my belief that we should do all we can to ensure that this sort of accident never recur. It is in the pursuit of this common interest that I am writing you.

I am aware that the Soviet Union is assisting the government of Cuba in the construction of a nuclear power facility near the town of Cienfuegos. In consideration of the tragic accident at Chernobyl, I believe that the Soviet government should halt construction on the Cienfuegos facility. The safety of Cuba and its neighbors of the Caribbean and the mainland demands no less than a halting of the construction for the time being.

It is clear that the safety of nuclear power plants is something of interest to all people throughout the world. As a representative of a state that neighbors on Cuba, I know that the people I represent are very concerned about the danger posed to them by an accident at a Cuban nuclear facility. I urge the Soviet government to acknowledge its responsibility to the rest of the international community for the safety of nuclear power facilities and halt the construction of the facility in Cuba.

Sincerely,

Paula Hawkins

Paula Hawkins
United States Senator

PH/hbs

Senator COCHRAN. Senator Hawkins, do you have any further comments?

Senator HAWKINS. I thank you, Mr. Chairman, for holding this hearing, and I think we have learned a lot here today, but I think we have really learned that we do not know very much about a lot of things, and my concern is that—without onsite inspections—we do not know anything about the kind of concrete that is being used or the kind of steel that is being used, and we do not really know enough to feel comfortable with a plant that is being built so close to our shores, and, in many instances, right among the relatives of so many of our citizens who are so close to our shores.

It is my concern that the Cuban people be kept safe, also, from any hazard that might come from building a poorly constructed and poorly designed facility.

I believe that we have gotten the attention of some of the agencies that are participating in the talks—the bilateral talks—and that they will continue to put a great amount of emphasis on the State Department and others as we approach the discussions in Vienna, and, with your attention and that of other members of the Senate, I am sure that we can bring this to a higher level of interest at the meetings held outside of the United States.

Thank you, Mr. Chairman.

Senator COCHRAN. Thank you very much, Senator Hawkins.

The hearing is adjourned.

[Whereupon, at 11:45 a.m., the committee was adjourned.]

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

Statement by Marcelo Alonso, Executive Director of FITRE, Florida Institute of Technology, and former Executive Secretary of the Interamerican Nuclear Energy Commission, (IANEC).

It is very difficult to make an accurate assessment of the Cuban nuclear power program since no detailed information is available to the writer. The most general information is contained in an article by Fidel Castro Diaz-Balart, Executive Secretary of the Cuban Atomic Energy Commission, which was published in 1985 in the bimonthly magazine "Cuba Socialista," which is the official publication of the Central Committee of the Cuban Communist Party. However, the article is a combination of a few technical facts, some general expectations, a lot of socialist propaganda, and several inaccuracies.

According to Fidel Castro D.B.'s article, the goal of the Cuban Government is to use nuclear energy to produce around the year 2000 about 25% of the electric power. Also, according to Fidel Castro D.B., the current electric generating capacity of Cuba is about 2400 MW (a figure which is debatable for reasons given below). Assuming a present rate of increase in electricity demand of 8%, which is the pre-revolutionary figure, and that most probably is too high, the generating capacity in Cuba in 2000 should be of the order of 7000 MW. Thus, if Fidel Castro D.B.'s predictions are correct, the total nuclear generating capacity of Cuba in 2000 would be about 1700 MW or four nuclear power units similar to the two under construction. 't is very doubtful that this goal can be reached.

To place in the proper perspective the Cuban Nuclear Power Program, it is convenient to recall the situation of electric power generation in Cuba at the time of the communist takeover in 1959. At that time the total electric power capacity

in Cuba was about 600 MW (not 397 as Fidel Castro U.N. claims) and as said above the demand was growing at about 8%. The largest unit was 66 MW, in Regla, near Havana. Plans were under way to add four units of 125 MW each in Mariel, on the West of Cuba. Also plans were completed for a small nuclear power plant of 40 MW to be built jointly by Mitchell Engineering (Great Britain) and American Machine Foundry (U.S.) in the province of Pinar del Rio. This nuclear project was cancelled in the middle of 1960.

It should be kept in mind that in general the electric power demand increases in proportion to the rate of economic and industrial growth. The main industrial sector in Cuba before and after 1959 is the production of sugar. Most sugar mills are practically energy self-sufficient because the bagasse they produce is used for fueling their own thermal power plants and to meet local energy needs. By all standards it is reasonable to assume that Cuba industrial output in other economic sectors has grown as a whole at a lower pace than at pre-revolutionary times. In addition the acquisitive power of the population is relatively low. Accordingly, it is very difficult to imagine that in the last 26 years the demand for electric generation has continued to grow at 8%. Thus, most probably the current electric generating capacity in Cuba must be well below 2400 MW. This assumption can be reinforced by the fact that in 1959 practically the whole Cuban territory was electrified and that, therefore, no substantial increase in electric demand could come from the extension of electricity supply to new sectors of the population, a situation quite different from that in other countries of Latin America, where large fractions of the population do not have access to centrally produced electricity.

All the preceeding considerations have been made to indicate that it is very difficult to justify on purely economic and commercial terms the construction of large electric power generating units, let us say of more than 250 MW.

On the other hand, it is important to recognize that Cuba is practically devoid of fossil fuels. In consequence Cuba depends mostly on imported oil for the thermal generation of electricity. From the strategic point of view this is a very undesirable situation. Thus strategically it is very important to assure a continuous supply of electricity even under abnormal conditions, such as a blockade. It is in this respect that nuclear energy is important for Cuba, as explained below.

Cuba has under construction two nuclear power plants, under a bilateral agreement with the USSR signed in 1976. The feasibility study, including the engineering and geological analysis, was concluded in 1979. The site chosen is Juraguá, near Cienfuegos, in the south-central part of Cuba. The construction of the first unit was begun in 1983 and that of the second in 1985. Therefore, it is highly improbable that these units be completed before 1988 and 1990 respectively, no matter how high might be the priority assigned to them. The reactors are of Soviet design and the supplier is Atomenergoexport (AEE), a Soviet outfit that supplies all nuclear reactors provided by the Soviet Union to its satellites.

Although the official capacity of the nuclear plants is 417 MW, it seems that the reactors are of the standard design supplied by the Soviet Union to its satellites and also used domestically. These are pressurized water reactors (PWR) with a capacity of 440 MW; units of 1000 MW are also available. So far there are under construction or in operation 45 Soviet-built PWR reactors of 440 MW and 26 of 1000 MW. The oldest one has been in operation since about 1970. The distribution of these nuclear reactors by country and size is as follows:

	440 MW	1000 MW
Bulgaria	4	-
Cuba	2	-
Czechoslovakia	12	-
Finlandia	2	-
German D.R.	6	-
Hungary	4	-
Poland	4	2
Rumania	1	3
Soviet Union	10	21

The Soviet PWR are in principle similar to those of the same type used in the Western World and Japan. They are completely different from the graphite-water cooled reactors (LGR) of Chernobyl, of which there are 27 in the Soviet Union, which is the only country that uses that design for power generation. No accident like that in Chernobyl can occur with a PWR. If proper precautions are taken, such as adequate containment structures the probability of a serious accident in a PWR are very low. This is substantiated by the fact that the only serious accident in a PWR (basically due to human error) at TMI released only 15 curies of radioactive substances, while at Chernobyl about 30,000,000 curies were released.

Although initially the Soviets did not enclose their nuclear reactors within a containing structure, they have changed that practice since a few years ago. Thus it is to be expected that the Cuban reactors will have a containment structure. In fact Fidel Castro D.B. has stated that "the containment has been designed to withstand the impact of an airplane, an earthquake or a hurricane." Although this is not a precise statement it gives a sort of hint that a containment structure is contemplated.

However, containment is not the only safety requirement of a nuclear power plant. Several other features related to the control and operation of the reactor are essential. And above all, it is the quality of the construction and the materials used as well as the expertise of the operators that is critical for a safe smooth operation of a nuclear power plant.

Cuba is training in the Soviet Union and some Eastern European countries a large number of technicians, which presumably will be involved in the operation of the nuclear plants and there is no apriory reason to believe that they will not be qualified to do so. Also, it is reasonable to assume that Soviet technicians will be in charge of the operation of the Cuban Nuclear Power Plants for the first few years and most probably they will continue to supervise their operation for many years to come.

Thus *if* the Juraguá nuclear plants are properly built and operated there is no reason to believe that they will pose a special risk for the population in Southern United States, and in particular in Florida. The big question is the "*if*," but for reasons given below we should not worry about it.

A matter related to the Cuban nuclear power plants is their proliferation risk. Can the Cuban government gain access to the plutonium produced in those reactors? If the nuclear agreement between the USSR and Cuba is similar to that between the USSR and the other satellites the answer is a rotund no. The Soviets impose in all their nuclear fuel supply contracts a take-back clause. The spent fuel elements, once they have reached their useful life in the reactor, are to be sent back intact to the Soviet Union and replaced by a fresh batch of fuel elements. Since there is no reason to believe that the Soviets will treat Cuba in nuclear matters in a more lenient way than the other satellites, we may feel confident that for the time being the Cuban government will not have a capability for making nuclear weapons from the fuel used in its nuclear power plants, (incidentally PWR's are not the best systems for producing weapon grade plutonium).

I would like to go back now to the strategic value of nuclear power in Cuba. As I said before Cuba does not have indigenous fossil fuels. Also, Cuba is a valuable strategic Soviet military base in the Western Hemisphere. In particular Cienfuegos is a Naval Base for Soviet nuclear submarines. A fuel load in a nuclear power reactor may allow it to run for about a year. If a spare set of fuel elements is available, a nuclear power plant could operate continuously for about two years. This would give Cuba an extraordinary autonomy and stability for electric energy supply. Thus the construction of two nuclear units with a total of 800 MW can be justified from the strategic point of view.

To reinforce this assumption, it can be estimated that each nuclear power reactor in Cienfuegos will save about 700,000 tons per year of oil, that has to be imported from the Soviet Union in oil tankers, a point emphasized by Fidel Castro D.B.

The same can be said of the longer term nuclear plans of the Cuban Government, Fidel Castro D.B. has indicated that two more identical units will be built at Juragua, bringing the total to about 1700 MW, although no date has been given for initiating their construction. Another two power installations of four units each might be eventually built, one group in the East and the other in the West of Cuba, bringing the total nuclear capacity of Cuba to 5000 MW in about two decades. However, given the present economic conditions of Cuba it seems very difficult to justify the need for such an extraordinary increase in nuclear generating capacity. Thus unless pressing strategic circumstances require so, these plans may never materialize.

To conclude, what can be done to make sure that the nuclear power plants in Cuba do not pose a risk? It is my personal opinion that because their strategic value, the Soviets will exercise maximum care in the building of such plants. Thus, the most sensible step for the U.S. is to use quiet diplomacy to obtain from the Soviets detailed information about the safety features of those plants. If that fails one could use the IAEA channels to obtain that information.

In parallel to this effort, the U.S. could press for the IAEA members to adopt criteria and guidelines for the design, construction and operation of nuclear power plants. The IAEA has already prepared some safety guidelines, but the member states are not required to adopt them. Once the guidelines are formally adopted, any country building a nuclear power plant has only to notify the IAEA officially that it is incorporating such criteria. Failure to do so may prompt the IAEA to inspect the construction and review the plans. This is probably the best that can be done now.

FLORIDA INSTITUTE OF TECHNOLOGY

MELBOURNE, FLORIDA 32901

FITRE
OFFICE OF THE DIRECTOR

PHONE (305) 723-3701

July 2, 1986

The Editor, Florida Today
Gannett Plaza
P.O. Box 363000
Melbourne, FL 32936

Dear Sir:

I wish to express my appreciation for the report by Chet Lunner on the U.S. Senate Hearing held in Miami on June 30 concerning the two nuclear power plants under construction in Cuba. However, there is one matter in the report that needs clarification. Although "in situ" inspection might be useful to obtain assurance about the quality of the construction, I did not recommend that measure, as the report implies. Among other things, "in situ" inspection might be politically undesirable and very expensive in practice. What I recommended is to try to obtain information from the Soviets about the safety measures built into the plant, and to try to adopt an international code for the design and construction of nuclear power plants, to which all countries that have nuclear plants must adhere. An inspection by the IAEA would be in order only in countries that do not adhere to the code.

Sincerely yours,

Marcelo Alonso
Executive Director

MA/in

STATEMENT OF
RICHARD H. VOLLMER
DEPUTY DIRECTOR FOR THE OFFICE OF NUCLEAR REACTOR REGULATION
U.S. NUCLEAR REGULATORY COMMISSION
BEFORE THE
COMMITTEE ON GOVERNMENTAL AFFAIRS
SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION, AND
GOVERNMENTAL PROCESSES
U.S. SENATE

JUNE 30, 1986

Mr. Chairman, it is a privilege to appear before you today to discuss the role of the Nuclear Regulatory Commission (NRC) in the regulation of nuclear power plants and the protection of the public health and safety.

The primary role of the NRC is to assure the protection of the public health and safety through licensing and regulatory oversight of nuclear source material, medical therapy and research facilities, as well as industrial facilities utilizing nuclear source material. Regulation of nuclear power plants represents a significant portion of the NRC's responsibilities, budget, and manpower.

The NRC performs an extensive review of the design of nuclear power plants to assure that the likelihood of accidents is reduced to a minimum and that the consequences of any accident are mitigated to the extent possible. This has led to a design concept called "defense in depth." By "defense in depth," we mean an approach that assures safety by:

(1) designing fundamental systems important to safety to withstand even severe challenges without failure,

(2) building and operating such systems to high quality standards, and

(3) postulating the failure of such systems and providing reliable additional systems to mitigate the consequences of such failure.

The "defense in depth" concept provides for conservative design and operation as well as redundant and diverse reactor safety systems to provide assurance that safety criteria are fully met.

The NRC's role in assuring safety at nuclear power plants begins early in the process, before construction begins. The Licensing process for a nuclear power plant is a two-stage process.

Prior to construction, the NRC receives and evaluates detailed information describing the site suitability, facility design, potential effects on the public health and safety resulting from facility operation, a description of the applicant's technical capabilities to undertake such a project, and a description of the quality assurance program. The NRC assures that the nuclear plant design meets licensing criteria. Public hearings are held prior to issuing a construction permit so that the general public may raise specific safety concerns and have a voice in the licensing process. After the NRC review and the hearing process determines that the nuclear plant design meets all applicable NRC requirements, a construction permit is issued. The NRC places a resident inspector onsite during the construction of a nuclear power plants, and in addition, carries out a number of detailed inspections during construction by teams of experts representing various engineering disciplines to assure that plant construction proceeds in accordance with the approved plans and in accordance with NRC's quality assurance requirements.

As the construction process nears completion, the NRC evaluates in detail the final plant design and construction to assure conformance with requirements. Detailed emergency plans are developed and exercised by the utility, along with State and local governments, FEMA, and the NRC to demonstrate that appropriate protective measures can be taken in the event of an emergency. In addition, we evaluate the utility's technical and management capabilities as well as the training and qualification of operations personnel, and put reactor operators through a rigorous examination and licensing process. A second public hearing is held on the facility design, construction, operation, and emergency plans. When construction is complete and the NRC has assured itself that the licensee has a competent staff and has complied with the detailed licensing requirements, an operating license can be issued.

Once a plant is in operation, the NRC maintains regulatory oversight through a variety of means. Two means of oversight include the resident inspectors stationed at the plant site and the Emergency Notification System (ENS). The resident inspector is responsible for monitoring licensee activities and assuring conformance to NRC regulations. Each plant has a special dedicated emergency hotline telephone located in the control room that is connected to the NRC's Incident Response Center. The Incident Response Center is manned 24 hours per day, seven days per week, and serves as the NRC's headquarters Emergency Operations Center in the event of a plant emergency. In addition, each licensee is required to report certain events which may have safety significance to the NRC on the ENS phone. Events reported to the NRC are further reviewed and followed up as necessary. In addition to the above activities, the NRC conducts an extensive inspection program at each operating

nuclear power plant to assure that the plant is operated and maintained in conformance with the requirements, that operator training and qualifications are maintained, and that NRC requirements imposed after the licensing process are implemented.

Earlier I talked about "defense in depth" as a means to assure public health and safety. Although substantial effort is placed on conservative design and operation to preclude an accident, as well as systems to prevent release of radioactive materials from the reactor system if an accident does occur, recent events have emphasized the importance of the additional defense required for U.S. nuclear plants, namely, strong containment buildings and effective emergency planning. The NRC requires a containment building with minimal allowable leakage. The containment building is the final of several engineered barriers between radioactivity released in the nuclear power plant and the general public. U.S. reactor containments have been designed to withstand pressure and temperature increases resulting from breaks in major coolant and steam lines. While these containments were not originally designed for core melt accident conditions, studies have shown that U.S. containments are capable of withstanding the challenges imposed by many of the severe accident events that have been postulated.

Finally, regulations of the NRC require that an operating license for a nuclear power plant may not be issued until we have determined that adequate measures can and will be taken in the event of a radiological emergency. As a result, a utility must develop and submit onsite and offsite Emergency Response Plans

which must be coordinated with state and local government bodies located within the Emergency Planning Zones (EPZ) surrounding the site.

The principal features of these emergency preparedness programs are:

(1) Detailed plans exist for protective measures for the public for a plume exposure EPZ of about 10 miles in radius and an ingestion pathway EPZ of 50 miles in radius. Within the plume exposure EPZ, sheltering and evacuation are planned for. Within about 50 miles, the control of milk products and other food stocks is planned for.

(2) Graded emergency action levels are specified. There are four different levels ranging from notification of an unusual event up to a general emergency. For all of these levels, state and local governments are notified by the utility within 15 minutes. For the most severe of these levels the public also must be notified and kept updated during the course of an accident.

(3) State and local government authorities can notify the public within 15 minutes after notification by the licensee.

(4) Each nuclear power plant has an on-site technical support center to aid in the management of a nuclear power plant during an accident and a near-site emergency operations facility for coordination with state and local governments.

(5) Public education programs exist on the nature of the hazard and appropriate actions during emergencies. Emergency preparedness information is distributed annually to the public within about 10 miles of each nuclear power plant.

(6) Periodic exercises are conducted to test utility, local, state, and federal emergency plans.

The Nuclear Regulatory Commission and the Federal Emergency Management Agency evaluate the emergency preparedness capabilities of the utilities and the state and local governments to ensure a state of readiness to respond by reviewing the emergency plans, performing implementation inspections, and observing and evaluating exercises.

Mr. Chairman, this completes my statement. I would be pleased to answer any questions you may have.

STATEMENT OF
DELBERT F. RUNCH
ACTING DEPUTY ASSISTANT SECRETARY FOR REACTOR DEPLOYMENT
U. S. DEPARTMENT OF ENERGY
BEFORE THE
COMMITTEE ON GOVERNMENTAL AFFAIRS
SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION, AND
GOVERNMENTAL PROCESSES
U. S. SENATE

JUNE 30, 1986

Mr. Chairman, I am privileged to appear before you today to discuss the Soviet-designed nuclear powerplants now under construction in Cuba. Clearly the interest in the reactors in Cuba has increased since the accident at Chernobyl.

Chernobyl is a global issue. U.S. scientists and engineers are working with many groups and international agencies to better understand what happened, and how we all can learn from the consequences of that accident. Soviet officials have stated that they will provide an analysis of the causes and consequences of the accident to the International Atomic Energy Agency (IAEA). Soviet officials are scheduled to provide their analysis to the IAEA in late August and U.S. representatives will attend that presentation.

It has now been 2 months since the accident at the Chernobyl powerplant. In that time, we have all sought to find the implications of this accident and the impact it may have on the safe use of nuclear power here and abroad. As we get more detailed analytical data, our capabilities to understand the full ramifications of the accident are improving.

Our reviews have necessarily included a reexamination of all of Soviet-developed nuclear powerplant concepts. We need to understand the extent to which the accident at Chernobyl was a result of the inherent characteristics of that type of plant and the extent to which the accident may be traced to more general problems with safety practices in the Soviet Union. The remarks that follow are based on a review of Soviet literature and data shared by countries, such as Finland, who have hands-on experience with Soviet-designed reactors.

The Soviet Union has nearly two dozen of the large RBMK reactors like Chernobyl in operation or under construction. These machines are light water-cooled, graphite moderated, pressure tube, boiling water reactors. They utilize on-line refueling while the reactor is operating. We know that most of the new construction in the Soviet Union is what are called VVER-1000s--pressurized water reactors with containments--and not the RBMK reactor design utilized at the Chernobyl power station. The Soviet Union does not export the RBMK reactor; instead, they export a version of a pressurized water-cooled reactor called the VVER reactor.

The Soviet VVER concept had its origins in a design developed in the early 1960's that is continuing to evolve. Power ratings have increased from about 300 megawatts electric (MWe) to about 1,000 MWe.

Those countries in which the VVER reactor design is operating or under construction are tabulated on the following page.

STATUS OF THE VVER-400 and VVER-1000 REACTOR DESIGN

		440 MWe Class		1000 MWe Class	
Country	Total	Operating	Under Construction	Operating	Under Construction
Bulgaria	2				2
Czechoslovakia	21	5	7		9
Cuba	2		2		
East Germany	10	4	4		2
Finland	2	2			
Hungary	4	2	2		
Poland	2		2		
Soviet Union	43	11*	0**	7	25**
TOTAL	86	24	17	7	38

SOURCE: International Atomic Energy Agency, as of December 31, 1985.

*Does not include 278 MWe Novo Voronezh-1, a precursor to the VVER-440's, which began operation in 1964.

**No more VVER-440's are being built in the Soviet Union. There are two 500 MWe-class PWRs under construction especially designed for district heating of cities.

Thus, there are 41 VVER-400 reactors operating or under construction, including the two under construction in Cuba.

The Soviet Union has, over time, made efforts to upgrade the safety of their new reactors, particularly on export models. The Soviet Union has actively participated in the IAEA nuclear safety standards program and maintains that these safety standards are the basis of its nuclear regulation. In 1983, a new State Committee for supervising the operation of the Soviet nuclear power industry--effectively an independent regulatory body--was established. These

more stringent safety practices have, no doubt, had some impact on the design of the Soviet VVER-440 export model being constructed in Cuba.

Nonetheless, there are some similarities and some differences between the VVER-440 and non-Communist designs for pressurized water reactors. Summary information is shown in the attached tables. In those tables, the Point Beach Nuclear Plant is used for comparison purposes. Point Beach is a pressurized water reactor of U.S. design that has a power rating on the same order as the VVER-440.

On the most basic level, the Cuban reactors have several important safety characteristics. First--as in the case of all U.S. reactors--the VVER-440 reactor has an overall negative temperature and power coefficient, which means that the reactor tends to be self-correcting in the event of equipment or operator malfunction. Secondly, the mass of water in the VVER-440 reactor is relatively large; this means that abundant water is available to the core in the event of an accident.

Redundant, diverse safety systems are a hallmark of U.S. reactor designs. The VVER-440 system has some of these systems. For example, protection against pipe breaks in the reactor is provided by air-tight loop equipment cells. Condenser-bubbler units help assure that the steam formed--if the hot, pressurized water is released--does not overpressure these cells.

The Cuban reactors are reported to have some special features, such as additional provisions to withstand earthquakes and materials appropriate for a tropical climate. What other special provisions have been included remains

to be seen. Certainly, Cuba--a member of the IAEA--will be following the reports and analyses on the Chernobyl event and may wish to make additional improvements to their facilities before they go into operation.

The Soviet Union provides a variety of services to assist those countries (including Cuba) that choose to construct and operate a VVER reactor. For example, one Soviet publication notes:

> "V/O "Atomenergoexport" provides technical assistance to foreign customers in constructing nuclear powerplants, nuclear research centers, including the provision of necessary equipment, and exports nuclear-, power-, and special equipment, materials, devices and instruments, including those designed for physical research and for solving applied problems of nuclear physics.
>
> V/O "Atomenergoexport" supplies nuclear-, power-, and special equipment which meets the highest present-day demands and ensures economical and trouble-free operation of the plants and facilities under any climatic and geological conditions. High operational reliability, economy and safety of the equipment delivered and the assistance rendered are guaranteed.
>
> V/O "Atomenergoexport":
>
> - performs surveying work for selection of a construction site.
> - performs projecting work, renders engineering services and carries out separate projecting-surveying assignments and experimental studies at the customer's request.
> - supplies the basic, auxiliary, building, installation and special equipment.
> - performs assembly and debugging work.
> - supplies nuclear fuel for nuclear powerplants.
> - sends highly skilled specialists to construction sites for the performance assembly and debugging work.
> - organizes training of national staff either in the USSR or in the customer's country."

In 1976, reactor development began in Cuba with the signing of a bilateral agreement with the Soviet Union. Four pressurized water reactors (PWR's) are planned. The first 2-reactor power station will be at Juragua on the southern coast of central Cuba, 10 miles from the port city of Cienfuegos. Cienfuegos is located approximately 180 miles from Key West. In 1979, engineering and geological research was completed and, after some preparatory work at the plant site, construction of the Juragua-1 plant was started in 1983. Work on Juragua-2 began in 1985. These PWR's are Soviet-designed VVER-440 reactors. The first unit is scheduled to enter service in 1987, followed by Unit 2 in 1990. Construction and operating personnel receive training from both the Soviet Union and Eastern Bloc countries.

The performance of the VVER-440 stations seems high, judging at least by the good results reported from Finland where the two units of the Loviisa station operated at load factors of 84.2 percent and 77.7 percent in 1982, and from Bulgaria where the Kozloduy station has averaged over 70 percent load factor. From 1977 to 1981, the first four units at Novovoronezh had an average load factor of 80 percent. The total operating experience of this type of VVER reactor amounts to 115 reactor-years, with the oldest station having reached 13 years.

We have reason to believe that Chernobyl will lead to the establishment of improved national and international cooperation in nuclear safety. We should be able to see some near-term results in the area of trans-boundary radiological releases, safety efforts that deal with severe accidents, emergency responses, and expanded international cooperation in the area of

nuclear safety. Chernobyl should be used not as a rallying cry against nuclear power but as a rallying cry for increased international safety vigilance, which has characterized the U.S. program since its inception.

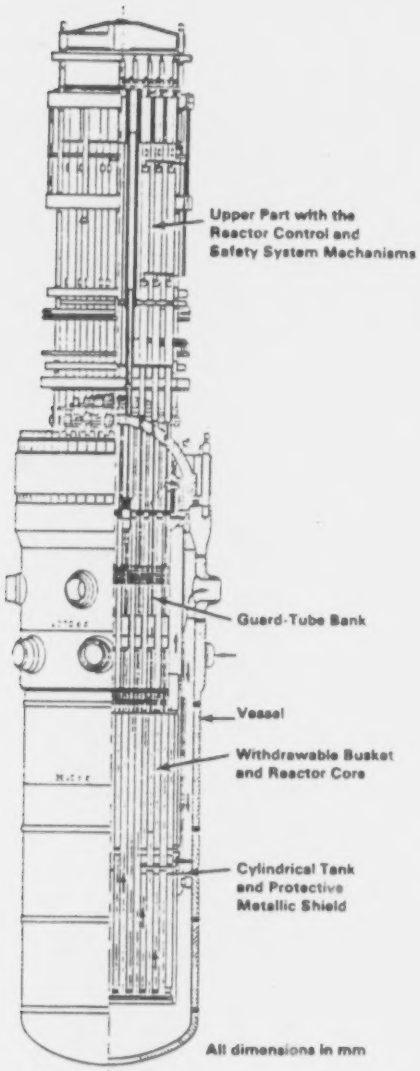
In the broader context, the use of nuclear power should enable Cuba to achieve a substantial reduction in its oil imports. In this regard, the Cuban program will complement the efforts of other nations to achieve a measure of energy security.

All nations share in the benefits that nuclear power brings should be prepared to take those steps to assure that their powerplants are designed and operated safely. The Cubans have stated their intent to do so.

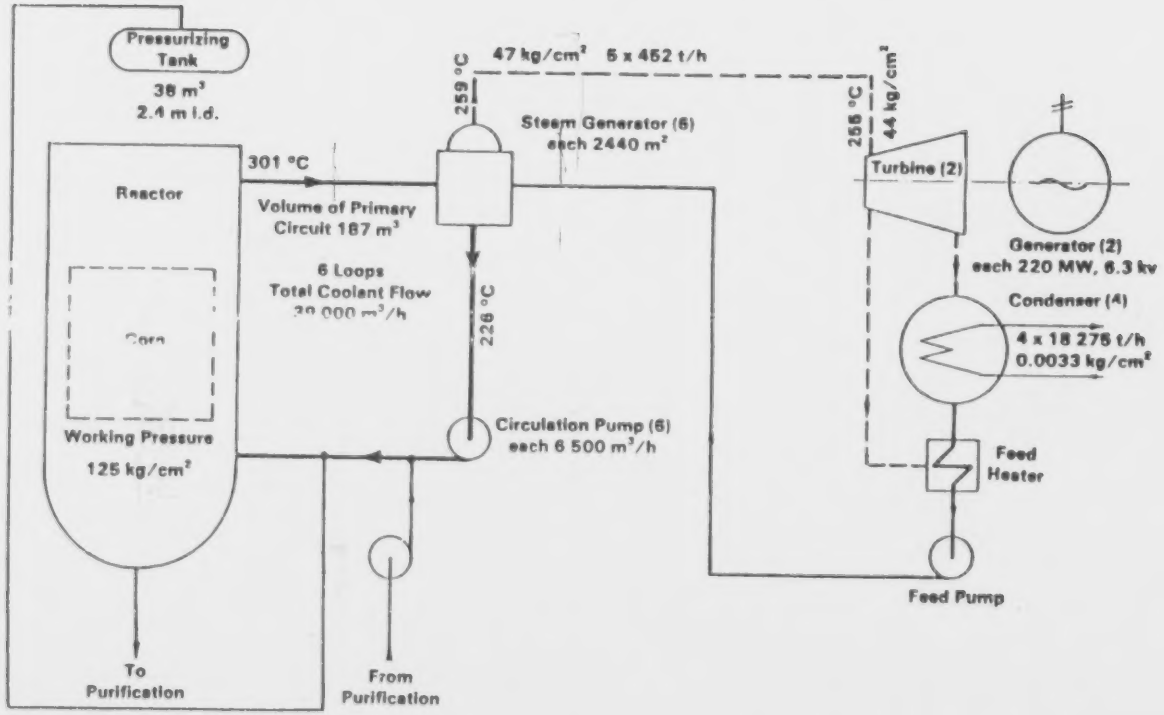
Mr. Chairman, this completes my statement. I would be pleased to answer any questions at this time.

FLORIDA
MIAMI
KEY WEST
HAVANA
CIENFUEGOS
CUBA
CAMAGUEY
SANTIAGO

Figure 1



Vertical Section
VVER-440 Side View
Figure 3



VVER 440

Figure 4

VVER 440 Designed Safety Features

- Maximum loss of coolant accident (LOCA) is instantaneous failure of a primary system main circulation pipe
- Emergency core cooling limits maximum clad temperature to 1200 degrees centigrade by fast-acting isolation valves and high and low pressure pumps
- Primary loop confinement cell and condenser-bubblers limit pressure to 2 kg/square centimeter
- Western PWR containment systems and structures provide containment pressures in the 2 to 5 kg/square centimeter range

	VVER-440	U.S. PWR[1]
Thermal Power (MWth)	1375	1518
Gross Electrical Power (MWe)	440	497
Average Power Density (MW/*l*)	83	95
Discharge Burnup (GWD/MTU)	28-30	33.0
Uranium In Core (MTU)	42	53.7
Uranium Enrichment (w/o U-235)	3.6	3.3
Maximum Fuel Temp (°C)	1940	2232
Primary Loop Coolant Temperature (°C)		
Inlet	269	289
Outlet	300	321
*Number of Loops	6	2
Primary Flow (T/hr)	45,900	61,000
*Mass of Water (T)	200	125

[1] Point Beach Nuclear Plant, Unit 1 (Wisconsin Electric Power Company and Wisconsin Michigan Power Company).

Similarities Between VVER and Other PWR Designs

- Core materials:
  - Uranium oxide fuel
  - Zirconium alloy clad
  - Stainless steel pressure vessels
  - Control rod neutron absorbing materials

- Reactor physics characteristics
  - Fuel burnups 28 to 33 GWd/MT
  - Uranium enrichments 3 to 4 wt. % U-235
  - Reactivity control: soluble boron and top vertical control rods
  - Core neutron spectrum
  - Negative temperature coefficients of reactivity

- Thermal design characteristics
  - Core power density approximately 100 kW/liter plus or minus 20
  - Indirect steam cycle
  - Similar coolant temperatures and pressures
  - Primary system pressure 120 to 160 kg/cm^2

(7)

Differences Between VVER 440 PWRs and U.S. PWRs

- Core is designed with hexagonal fuel assemblies instead of square assemblies
- Fuel assemblies are individually shrouded in zirconium metal instead of an open lattice of fuel rods
- Some control rods have movable fuel assemblies below the neutron absorbing section. This necessitates space below the core active section to accommodate the follower fuel when the control rod is fully inserted
- All U.S. and non-communist world PWRs have containment including the VVERs in Finland
- VVERs employ horizontal tube steam generators. All other PWR type have vertical tube steam generators
- VVERs have 6 primary coolant loops, compared to a range of 2 to 4 for other PWR designs

UNITED STATES SENATE

Committee on Governmental Affairs

Subcommittee on
Energy, Nuclear Proliferation, and
Government Processes

Testimony by

Lester Machta, Director
Air Resources Laboratory
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

June 30, 1986

Miami, Florida

Thank you, Mr. Chairman

Radioactivity released to the atmosphere from nature, nuclear facilities, or a nuclear detonation is carried by air currents and becomes deposited by the vagaries of the weather. We know of no means by which the radioactivity might be artificially removed from the air.

Airborne radioactivity can best be tracked with sampling instruments aboard airplanes; a process that allows a large degree of mobility in the search for the radiation. When aircraft sampling is not possible, as was the case within the Soviet Union during the recent Chernobyl accident, it is possible to estimate with some reliability the location and movement of the air which contains the radioactivity from meteorological observations.

Most of mankind's previous experience regarding the long distance transport of radioactivity was derived from the era of atmospheric nuclear testing in the 1950's and early 1960's and a few subsequent nuclear tests. However, the release of radioactivity to the air from a nuclear power station accident differs in at least one way from that produced by nuclear tests. The radioactivity is injected near the ground and not at high altitudes as with tests. The two scavenging mechanisms that physically remove the radioactivity from the air, namely, wet and dry fallout, are more effective when a radioactive cloud is near the ground rather than at high altitudes.

My organization, the National Oceanic and Atmospheric Administration (NOAA), does not monitor radioactivity in air. With its meteorological expertise, it can provide forecasts on the movement of air containing radioactivity and where rain is likely to deposit the radioactivity. The Department of Energy, through its Lawrence Livermore National Laboratory, provides a similar

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service, especially for releases from facilities within the United States. NOAA, however, is responsible for tracking other forms of environmental pollution such as volcanic dust, radioactivity from foreign atmospheric nuclear tests, and smoke from forest fires. In doing so, it receives assistance from other agencies and promptly reports its findings to them. We use computer terminals linked by telephone to the National Weather Service, National Meteorological Center, near Washington, D.C. in order to obtain up-to-date meteorological data. Our 30 or more years of experience and research using atmospheric pollutants and tracers permits expert on-the-spot judgements of various factors like cloud rise, movement over irregular terrain, and rain effects that must be taken into account.

NOAA Climatology Capabilities

I am now going to address the air flow from Cienfuegos, Cuba to various locations in the Gulf of Mexico, the Caribbean, Central America, and particularly, the southeastern United States.

Exhibit 1 shows a map with air trajectories that originate from a power plant that is proposed for Cienfuegos. These trajectories trace the flow for centerline of the air, or air containing radioactivity if any were released. The altitudes chosen for the calculations, near sea level and 5000 ft., were selected because, in our estimation, they are the most relevant to a radioactive release from a nuclear power plant and because they are standard levels in the atmosphere where weather analyses are available. Both trajectories start on January 1, 1985 and the numbers along each trajectory indicate daily (24 hour) positions after start. Note that the paths differ. Had we run trajectories

at levels between the two shown on the Exhibit, they would likely lie somewhere in between. In addition to transport along a trajectory path, a mass of air would spread horizontally with time so that after two days of travel, it might have a radius of about 100 miles or so around the two-day point on the centerline shown on the Exhibit.

Trajectories calculated in a similar manner are used for Exhibit 2 which shows the probability of any point in the Gulf, the Caribbean, Central America, and the southeastern United States being overridden by air which initially started from Cienfuegos. This picture presents the annual average probability derived from all weather patterns in 1984--the picture for 1985 (Exhibit 8 in the Appendix) was not much different. One could interpret Exhibit 2 as follows: if radioactivity were constantly emitted from Cienfuegos, the numbers would reflect the percentage of the time air containing radioactivity would pass over an area, or viewed in another way, the percentage of the time a monitoring station in that area would detect the radioactivity in air, or if it rained, in rainwater. For example, radioactivity could be expected over southern Florida about 25% of the time.

The probability of air from Cienfuegos passing over an area as shown in Exhibit 2 applies to an entire year. More detailed information on probabilities can be obtained by considering periods shorter than one year. We have chosen a 3-month interval as the shortest representative period for air flow statistics based on the twice-daily trajectories. For example, during the period January through March 1984, the likelihood of southern Florida being affected by air orginating from Cienfuegos is about 45% as shown in Exhibit 3, which is much greater than the annual value of 25%. The other 3-month probabilities for 1984

and 1985 appear in the Appendix. It should be emphasized that, unlike the year-to-year similarities of the annual percentages, seasonal probabilities can differ significantly reflecting seasonal changes. In addition, any one season can differ from year to year because of geographic shifts in large scale weather patterns. As an example, the probability of southern Florida being affected by air from Cienfuegos was about 45% during January-March 1984 but only about 25% during the next 3-month period of April to June 1984 (see Appendix, Exhibit 6). The 3-month differences from one year to the next can be illustrated by considering the 45% probability in southern Florida for January-March 1984 as compared to about 30% for the same 3-month period in 1985 (see Appendix, Exhibit 10). When applying any of the above probabilities we emphasize that, for any single nuclear accident, the radioactivity would take one specific path based on the air flow at that time and would, therefore, either "hit" or "miss" southern Florida.

Exhibit 4 shows the average time it takes air from Cienfuegos to reach an area on the map. Thus, on those times when the air moves to southern Florida, it will take, on the average, about 2 to 3 days. Exhibit 5 shows the shortest travel time to an area from Cienfuegos. For southern Florida, the shortest time is less than 1 day rather than the average time of 2 to 3 days. An earlier arrival, with less horizontal spread, allows greater dry deposition or wet deposition if rain is encountered, and less radioactive decay.

In this statement, Mr. Chairman, there have been no estimates of amounts of radioactivity or hazard to people or the environment. These estimates lie outside NOAA's area of expertise. NOAA will advise when and where radioactivity injected into the atmosphere might reach sensitive areas so that appropriate monitoring or other steps can be taken.

Appendix to Testimony of Dr. Lester Machta, NOAA, 30 June 1986

Miami, FL

This appendix amplifies and explains some of the statements and Exhibits in the body of the testimony.

1. Preparation of trajectories of air originating at Cienfuegos.

It is difficult to predict in advance the atmospheric layer that transports radioactivity following a nuclear reactor accident. The best judgement of NOAA scientists calls for transport mainly in layers at or below 5000 ft. altitude. Therefore, the path of air from Cienfuegos, Cuba has been calculated at an altitude near sea level and at 5000 ft. starting at 00 GMT (Greenwich Mean Time) and 12 GMT every day in 1984 and 1985. Meteorological analysis needed as input to NOAA trajectory computer programs are readily available at these altitudes and times. The mass of air at each of these altitudes is permitted to spread horizontally as it moves along a trajectory path such that its radius in nautical mile equals two times the travel time expressed in hours (e.g., after 24 hours of travel, the radius would be 48 nautical miles). Each trajectory is computed for 10 days; Exhibit 1 shows only part of the calculated trajectory paths.

2. Climatology of air from Cienfuegos.

Calculations were made of the percent of time air from Cienfuegos overrode a grid 0.2 degrees latitude and 0.2 degrees longitude over the map area shown in Exhibit 2 of the testimony. Trajectories were started twice daily at 2 altitudes for two one-year periods. A single trajectory was counted only once for each grid point. The number of times that the air passed over a grid was then divided by 732 (two trajectories per day for one year) and then multiplied by

100 to express the number in a percentage. Percentages from the two altitudes were combined to produce the Exhibit.

For Exhibit 3 of the testimony, the same procedure was employed but the percentages were obtained by dividing by 182 (two trajectories per day for 91 days between January 1 through March 31, 1984). The same procedure was used to obtain the percentages on Exhibits 6 through 8 and 10 through 13 in this Appendix.

For each instance of air overriding the 0.2 by 0.2 degree grid, the time of arrival in hours was determined for each of the two altitudes and an average was computed. In addition, the first arrival was also noted. Analyses of average and first arrival times appear on Exhibits 4 and 5, respectively.

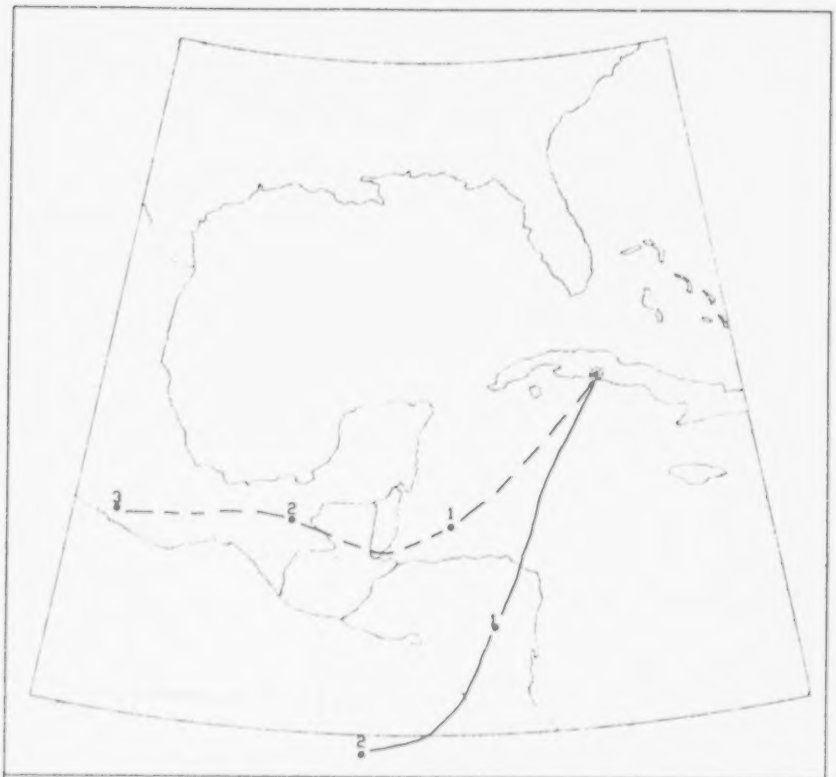

Exhibit 1. Trajectories of air originating at Cienfuegos, Cuba for January 1, 1985 at 00 Greenwich Time for sea level (solid) and 5000 feet (dashed). The numbers indicate positions at daily (24 hour) intervals after start time.

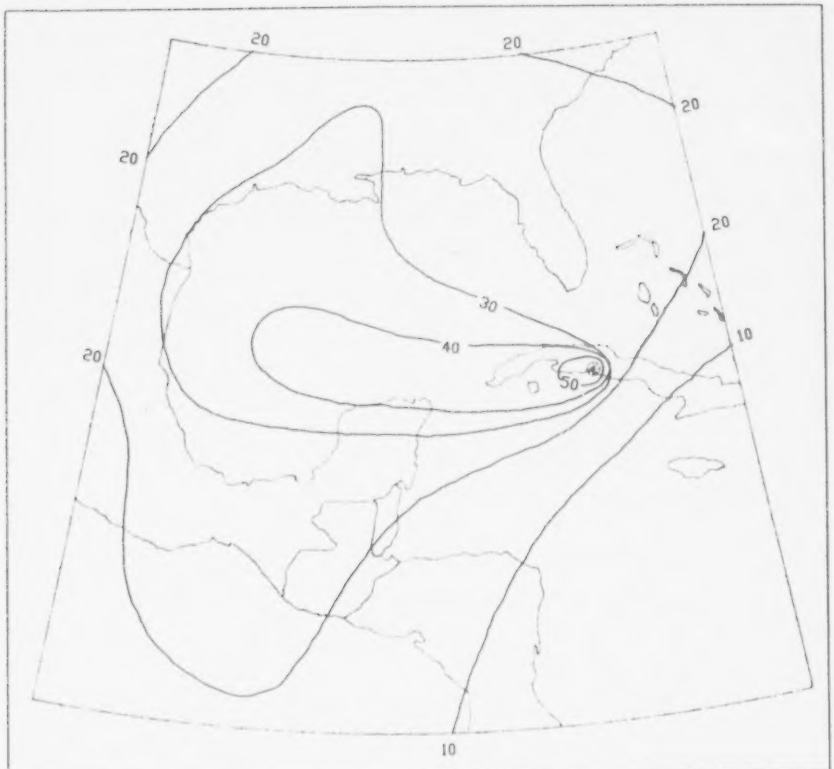

Exhibit 2. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the course of the year 1984.

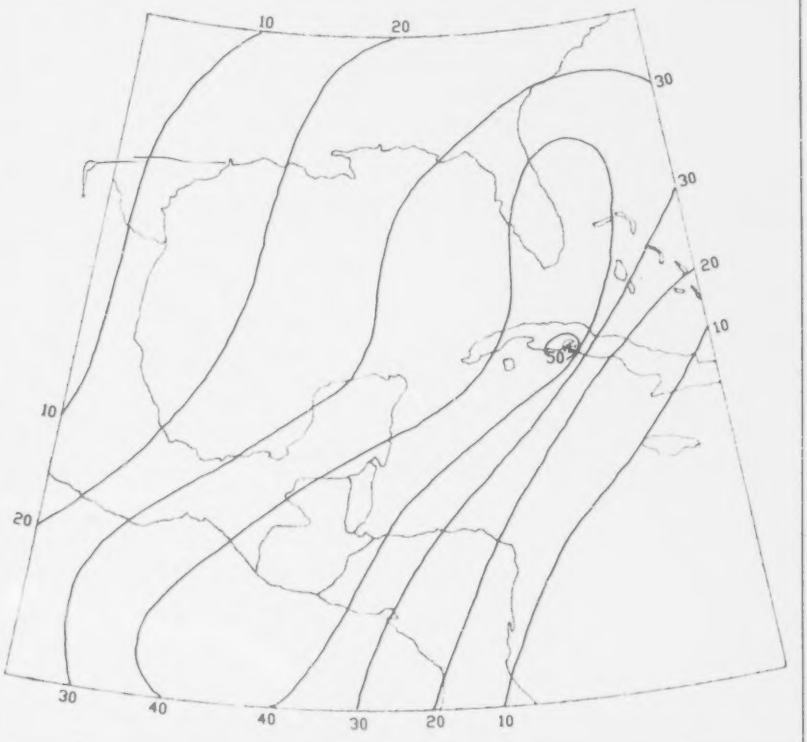

Exhibit 3. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period January 1 through March 31, 1984.

Exhibit 4. Average time, in days, for air to travel from Cienfuegos, Cuba based on a year of trajectory calculations (1984).

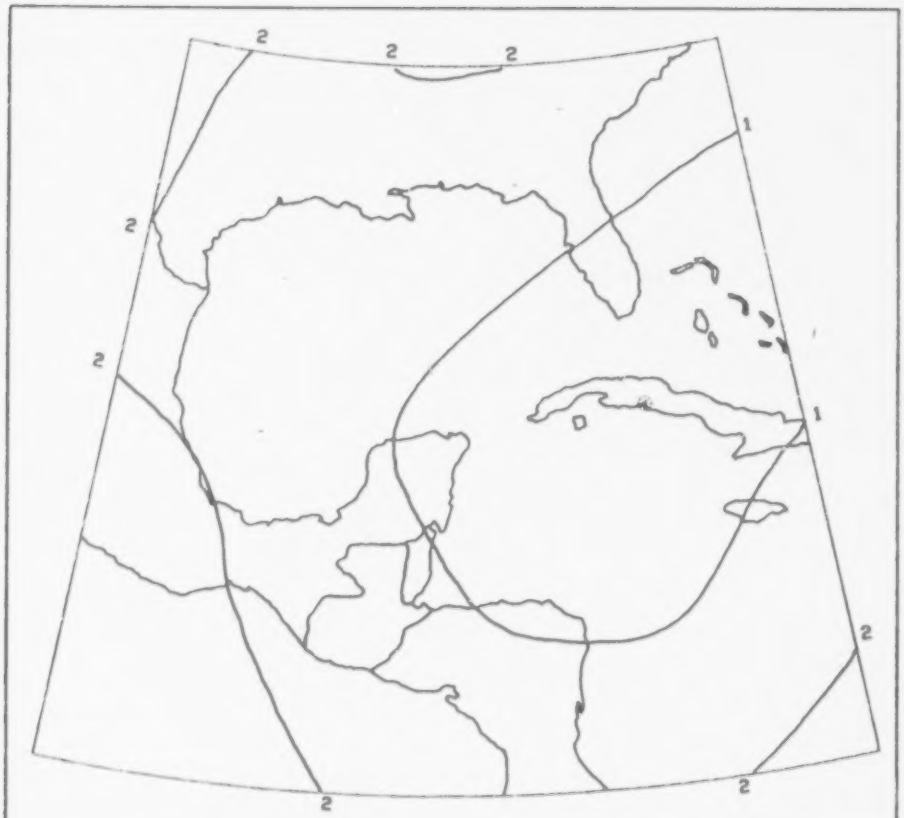

Exhibit 5. Earliest arrival, in days, of air from Cienfuegos, Cuba based on a year of trajectory calculations (1984).

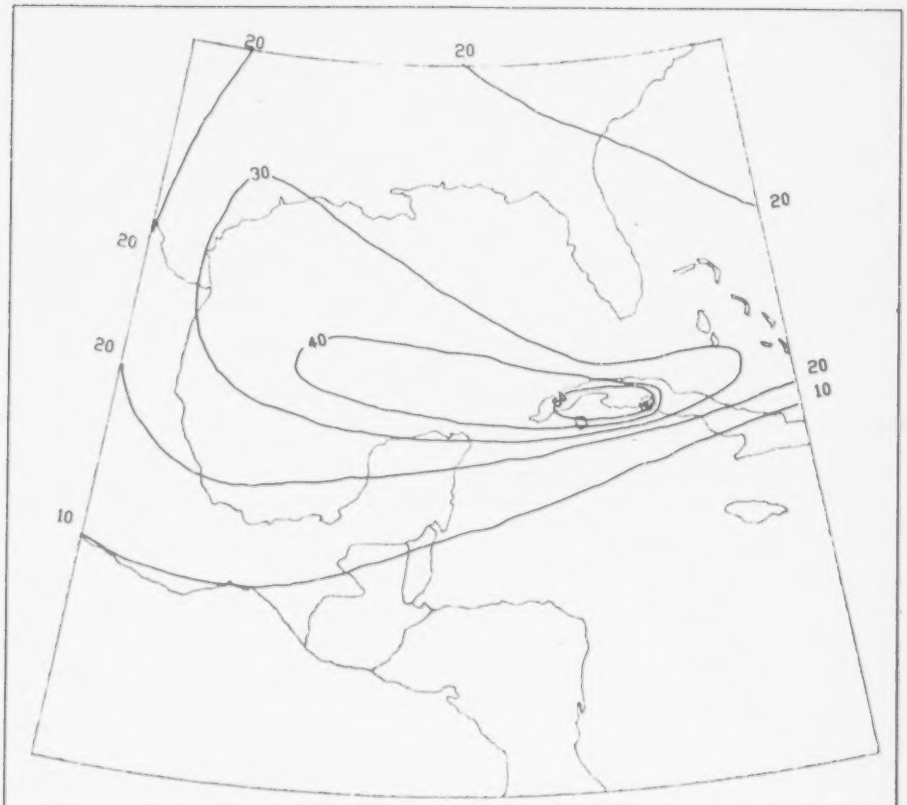

Exhibit 6. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period April 1 through June 30, 1984.

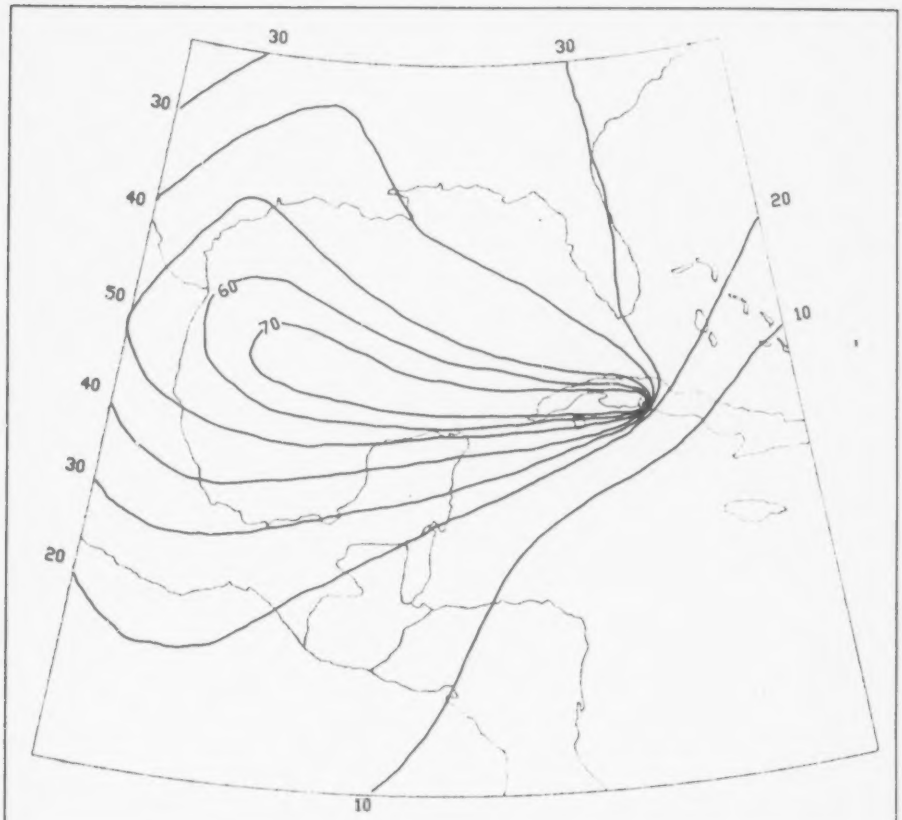

Exhibit 7. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period July 1 through September 30, 1984.

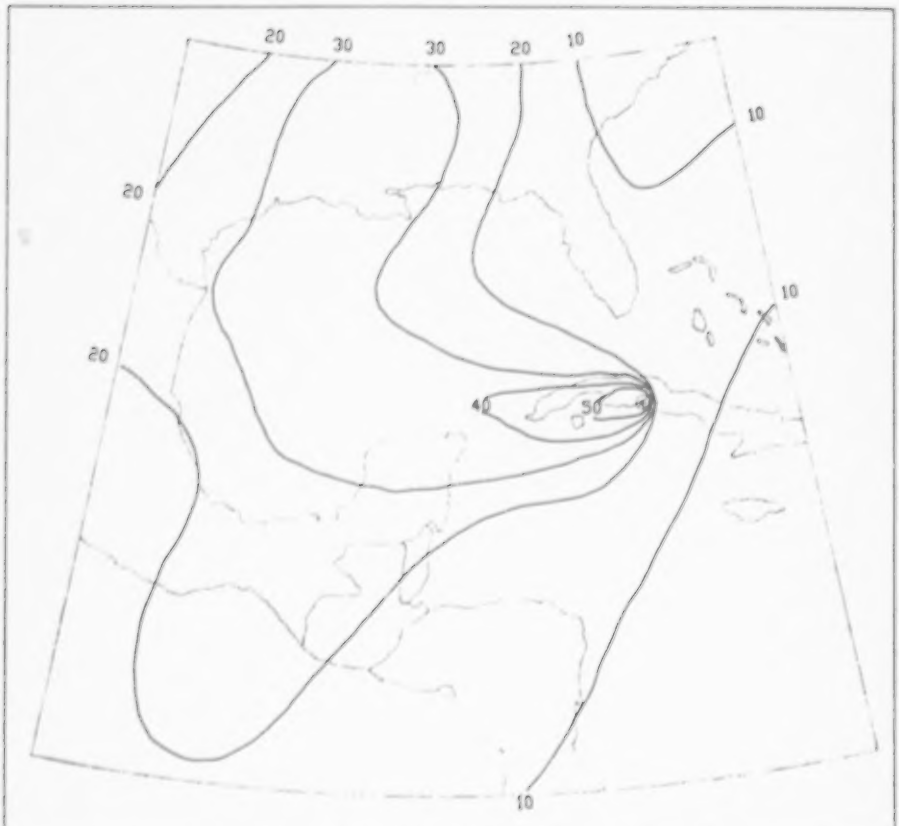

Exhibit 8. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period October 1 through December 31, 1984.

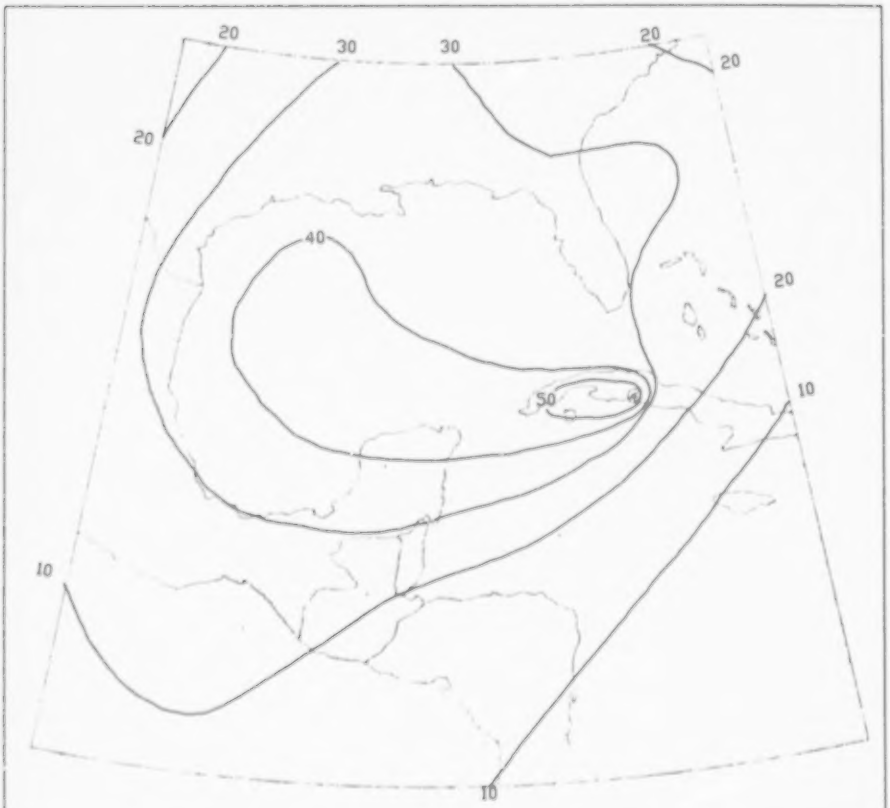

Exhibit 9. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the course of the year 1985.

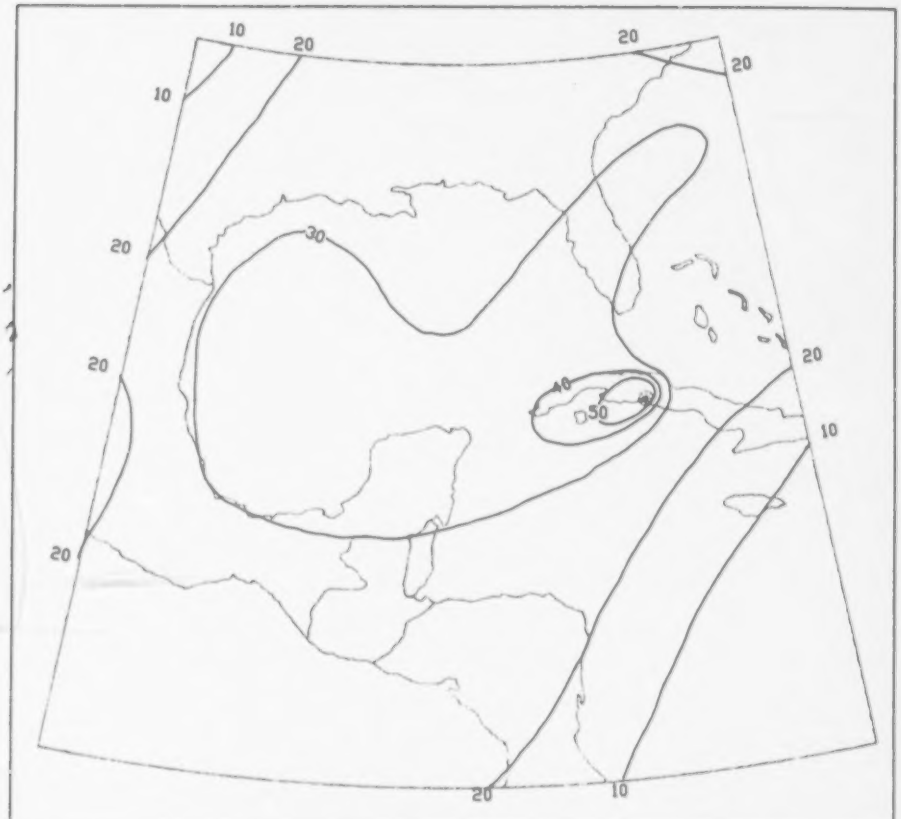

Exhibit 10. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period January 1 through March 31, 1985

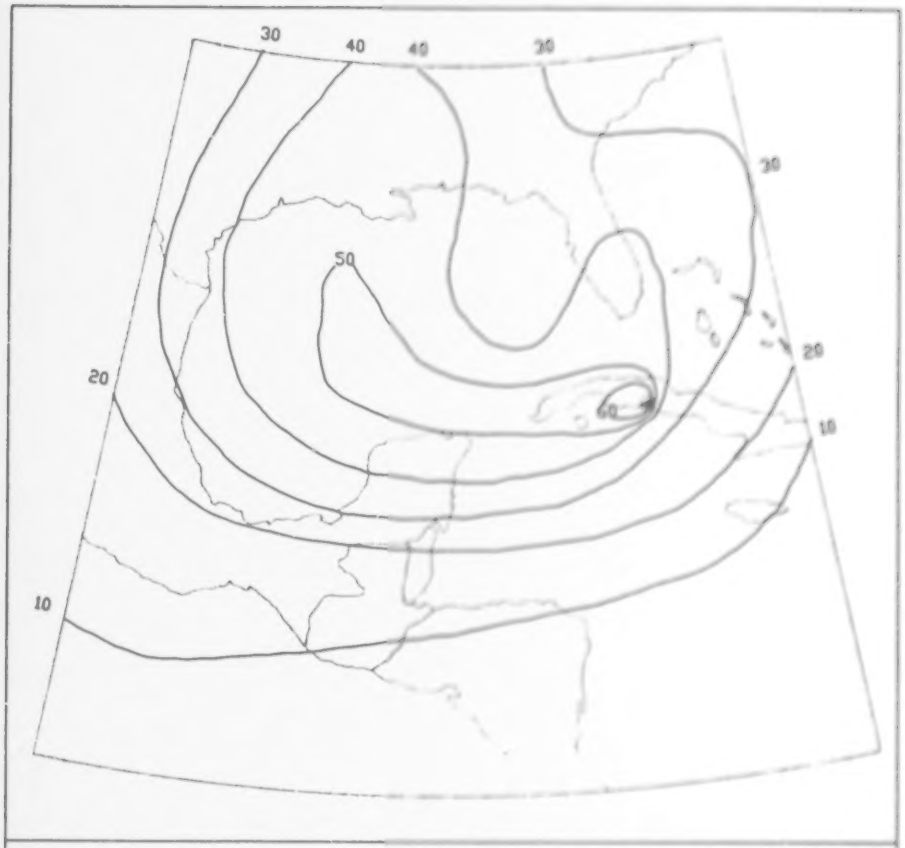

Exhibit 11. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period April 1 through June 30, 1985.

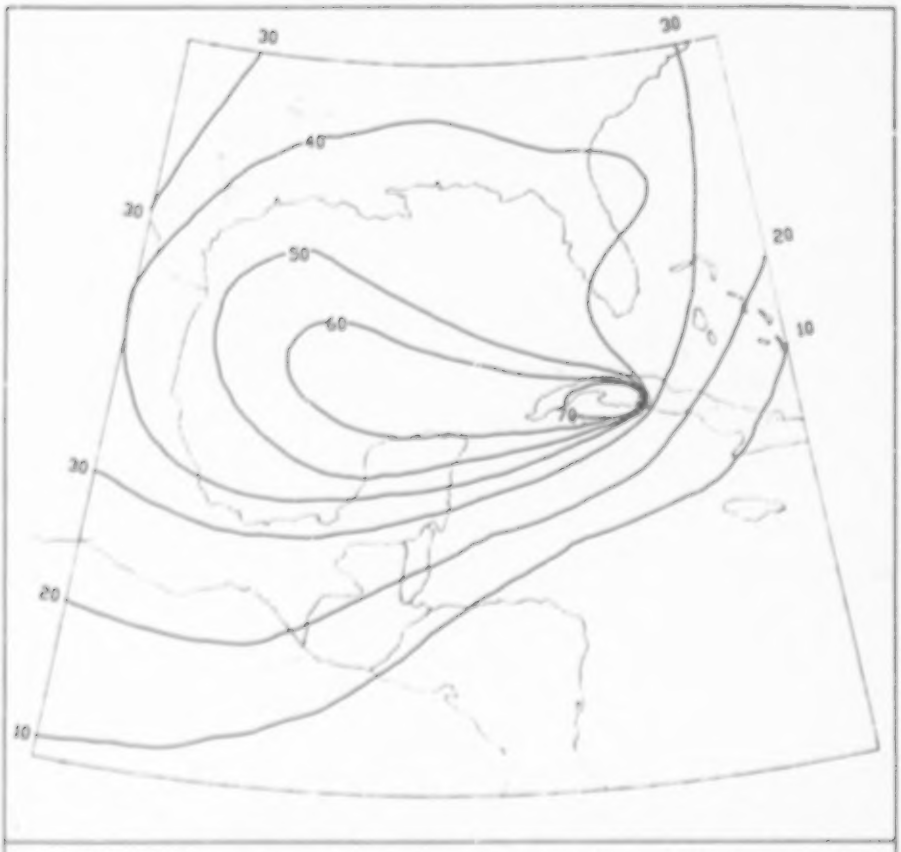

Exhibit 12. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period July 1 through September 30, 1985.

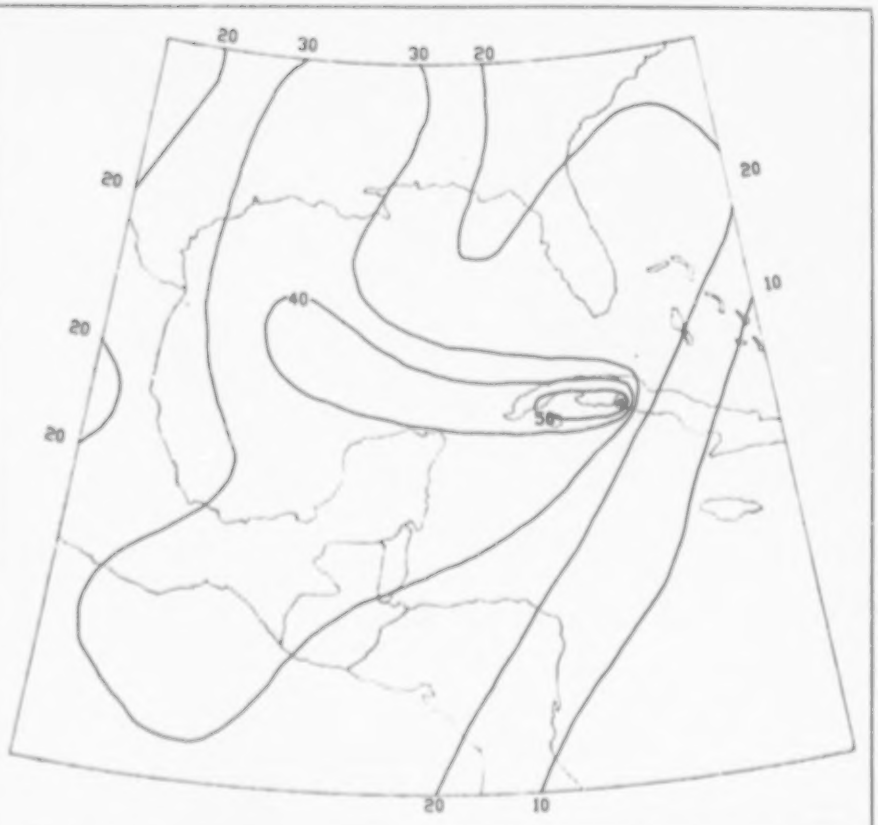

Exhibit 13. Percentage of time that air originating at Cienfuegos, Cuba would override an area during the period October 1 through December 31, 1986.

UNITED STATES SENATE

COMMITTEE ON GOVERNMENT AFFAIRS

SUBCOMMITTEE ON
ENERGY, NUCLEAR PROLIFERATION, AND
GOVERNMENT PROCESSESS

TESTIMONY BY

ALLEN SESSOMS, DIRECTOR
OFFICE OF NUCLEAR AND SAFEGUARDS
U.S. DEPARTMENT OF STATE

JUNE 30, 1986

MIAMI, FLORIDA

MR. CHAIRMAN:

I AM PLEASED TO HAVE THIS OPPORTUNITY TO TESTIFY TODAY REGARDING THE SOVIET-SUPPLIED NUCLEAR POWER REACTORS UNDER CONSTRUCTION AT JURAGUA IN CIENFUEGOS, CUBA. YOU REQUESTED COMMENTS ON THE CUBAN PROGRAM AND ITS INTERNATIONAL SAFETY IMPLICATIONS.

IN MY REMARKS TODAY I WOULD LIKE TO COVER A NUMBER OF TOPICS, INCLUDING OUR EFFORTS TO LEARN MORE ABOUT THE REACTORS' SAFETY SYSTEMS, LESSONS TO BE LEARNED FROM CHERNOBYL AND OUR EFFORTS INTERNATIONALLY TO IMPROVE COOPERATION IN NUCLEAR SAFETY.

THE ACCIDENT THIS PAST APRIL AT A SOVIET NUCLEAR POWER REACTOR AT CHERNOBYL IN THE UKRAINE, LEADING TO THE RELEASE OF LARGE AMOUNTS OF RADIOACTIVE MATERIAL FROM THE REACTOR'S CORE AND THE SPREAD OF RADIOACTIVE CONTAMINATION OVER A WIDE AREA, INCLUDING MANY COUNTRIES BEYOND THE BORDERS OF THE SOVIET UNION, WAS DRAMATIC PROOF THAT A SERIOUS NUCLEAR ACCIDENT IN ONE COUNTRY CAN HAVE REPERCUSSIONS FAR BEYOND THAT COUNTRY'S BORDERS. THE CHERNOBYL DISASTER HAS ALSO RAISED A NUMBER OF IMPORTANT QUESTIONS HAVING TO DO WITH A COUNTRY'S OBLIGATION TO PROVIDE ADEQUATE WARNING AND INFORMATION TO NEIGHBORS LIKELY TO BE AFFECTED BY SUCH ACCIDENTS; THE NEED FOR ENHANCED

PREPAREDNESS ON THE INTERNATIONAL LEVEL TO RESPOND TO CIVIL NUCLEAR EMERGENCIES: AND, IN THIS PARTICULAR CASE, THE SAFETY OF SOVIET REACTOR DESIGN, CONSTRUCTION, AND OPERATING PRACTICES.

THE LATTER CONSIDERATIONS ARE THE FOCUS OF ATTENTION AT THIS HEARING BECAUSE THE SOVIETS ARE AT PRESENT BUILDING TWO 440MW POWER REACTORS IN CUBA, WITHIN A FEW HUNDRED MILES OF OUR SHORES.

WE KNOW THAT THE REACTORS BEING BUILT IN CUBA ARE NOT OF THE CHERNOBYL TYPE. THEY ARE WATER RATHER THAN GRAPHITE MODERATED AND WE BELIEVE WESTERN TYPE CONTAINMENTS ARE PLANNED. IN MY TESTIMONY TODAY I WOULD LIKE TO DESCRIBE OUR DISCUSSIONS WITH THE SOVIET UNION AND CUBA REGARDING THE INFORMATION WE NEED ABOUT THE SAFETY OF THE REACTORS UNDER CONSTRUCTION IN CUBA. WE HAVE A LEGITIMATE INTEREST IN ASSURING THAT THESE REACTORS ARE DESIGNED AND BUILT TO EXACTING SAFETY STANDARDS, AND THAT THEY WILL BE OPERATED IN A SAFE MANNER AT ALL TIMES. I WILL ALSO ADDRESS THE EFFORTS WE ARE NOW UNDERTAKING, PRINCIPALLY THROUGH THE INTERNATIONAL ATOMIC ENERGY AGENCY, TO EXPAND INTERNATIONAL COOPERATION IN NUCLEAR SAFETY.

THE DEPARTMENT OF STATE HAS DISCUSSSED WITH SOVIET REPRESENTATIVES OUR INTEREST IN LEARNING MORE OF THE PLANNED

SAFETY FEATURES OF THE CUBAN REACTORS. THE SOVIETS RESPONDED POSITIVELY AND WE HAVE AGREED TO PUT THIS SUBJECT ON THE AGENDA OF A US/SOVIET BI-LATERAL MEETING ON NUCLEAR MATTERS. THIS MEETING IS SCHEDULED FOR LATE JULY IN MOSCOW. WE PLAN AT THAT TIME TO QUERY THE SOVIETS ON SPECIFIC SAFETY FEATURES WHICH RELATE TO OCEANSIDE SITING, TROPICAL WEATHER CONDITIONS, AND THE STRUCTURAL DESIGN OF THE CONTAINMENT. IN THE WAKE OF THE CHERNOBYL DISASTER, THE SOVIETS HAVE BEEN FORTHCOMING IN DISCUSSIONS ON SAFETY ISSUES, SO WE BELIEVE OUR CONVERSATIONS WILL BE USEFUL.

THE CUBANS HAVE SAID THAT A "SERIES" OF CONTAINMENT STRUCTURES ARE PLANNED FOR THEIR REACTORS. THEY HAVE ALSO SAID THAT THE PLANT IS DESIGNED TO WITHSTAND EARTHQUAKES AND HURRICANES. A CUBAN OFFICIAL DESCRIBED THE SYSTEM AS CONSISTING OF FUEL CASINGS, A SEALED PRIMARY CIRCUIT AND AN ENCLOSURE FOR ALL SYSTEMS AND COMPONENTS OF THE PRIMARY CIRCUIT. WE INTEND TO PURSUE THE DETAILS OF THESE STATEMENTS.

OUR INTEREST SECTION IN HAVANA IS ALSO SEEKING INFORMATION REGARDING THE REACTORS. IT IS MAKING KNOWN OUR CONCERN THAT THE REACTORS ENCORPORATE THE BEST POSSIBLE SAFETY FEATURES IN BOTH CONSTRUCTION AND OPERATION.

WE HAVE DISCUSSED THESE SAFETY ISSUES WITH OTHER NATIONS OF THE REGION AND WE BELIEVE THEY SHARE OUR LEGITIMATE INTEREST IN THIS SUBJECT.

LET ME TURN NOW TO THE MORE GENERAL QUESTION OF HOW THE INTERNATIONAL COMMUNITY IS WORKING TO EXPAND COOPERATION IN NUCLEAR SAFETY.

THERE IS ALREADY A BROAD CONSENSUS THAT FOR EACH COUNTRY THE MAINTENANCE OF SAFETY AND SECURITY OF NUCLEAR ENERGY IS AN INTERNATIONAL RESPONSIBILITY, NOT MERELY A PURELY NATIONAL ONE. EACH COUNTRY ENGAGED IN NUCLEAR POWER GENERATION BEARS FULL RESPONSIBILITY FOR THE SAFETY OF THE DESIGN, MANUFACTURE, OPERATION AND MAINTENANCE OF ITS INSTALLATIONS. A STATEMENT BY THE LEADERS OF SEVEN MAJOR INDUSTRIAL NATIONS, INCLUDING PRESIDENT REAGAN, AND RESPRESENTATIVES OF THE 12-NATION EUROPEAN COMMUNITY, MADE AT THE TOKYO SUMMIT MAY 4 IN THE IMMEDIATE AFTERMATH OF THE CHERNOBYL ACCIDENT, MAKES CLEAR THAT THESE PRINCIPLES ARE WIDELY SHARED. THE SUMMIT STATEMENT ALSO ENDORSED IAEA'S GUIDELINES ON NOTIFICATION OF ACCIDENTS AND ON EMERGENCY ASSISTANCE AND URGED THE ELABORATION OF AN INTERNATIONAL CONVENTION COMMITTING PARTIES TO REPORT AND EXCHANGE INFORMATION IN THE EVENT OF NUCLEAR EMERGENCIES OR ACCIDENTS. A NEGOTIATING SESSION DEALING WITH CONVENTIONS ON NOTIFICATION AND EMERGENCY ASSISTANCE WILL COMMENCE IN VIENNA

THE WEEK OF 21 JULY. INDEED, THE SOVIET UNION HAS RECOGNIZED THE NEED TO ESTABLISH MECHANISMS IN THESE AREAS AND WE HOPE THE SOVIET UNION WILL VIGOROUSLY SUPPORT THE ADOPTION OF THESE CONVENTIONS.

AS THE SUMMIT LEADERS NOTED, THE INTERNATIONAL ATOMIC ENERGY AGENCY HAS BEEN ACTIVE FOR SOME TIME IN SEEKING TO IMPROVE INTERNATIONAL COOPERATION IN THE SAFETY OF NUCLEAR INSTALLATIONS, THE HANDLING OF NUCLEAR ACCIDENTS AND THEIR CONSEQUENCES, AND THE PROVISION OF MUTUAL EMERGENCY ASSISTANCE. IN VIEW OF THE AGENCY'S BROAD MEMBERSHIP, ITS CREDIBILITY, AND ITS ESTABLISHED PROGRAMS IN THE NUCLEAR SAFETY FIELD, THE UNITED STATES BELIEVES THAT THE IAEA SHOULD BE A MAJOR FOCAL POINT FOR FURTHER INTERNATIONAL WORK IN THIS AREA. INDEED, WITH STRONG SUPPORT FROM THE UNITED STATES, THE AGENCY HAS ALREADY TAKEN A NUMBER OF IMPORTANT STEPS.

IN EARLY MAY, WHILE EVENTS AT CHERNOBYL WERE STILL UNFOLDING, THE UNITED STATES, TOGETHER WITH A NUMBER OF ITS ALLIES, CALLED FOR A SPECIAL MEETING OF THE IAEA BOARD OF GOVERNORS TO CONSIDER MEASURES TO STRENGTHEN INTERNATIONAL COOPERATION IN NUCLEAR SAFETY. THE SPECIAL BOARD MEETING CONVENED ON MAY 21. THE DELEGATIONS, INCLUDING, SIGNIFICANTLY, THAT OF THE SOVIET UNION, WERE UNANIMOUS IN CALLING FOR URGENT IAEA ACTIONS TO DEVELOP INTERNATIONAL RULES FOR EARLY

NOTIFICATION OF NUCLEAR ACCIDENTS AND FOR AN EMERGENCY RESPONSE MECHANISM. SPECIFICALLY, THE SPECIAL BOARD AUTHORIZED THE AGENCY'S DIRECTOR GENERAL, HANS BLIX, TO PREPARE A SET OF DETAILED PROPOSALS FOR AGENCY ACTION, AND THESE WERE APPROVED BY THE REGULAR BOARD MEETING IN JUNE. THE WORK PROGRAM THUS ESTABLISHED INCLUDES:

-- FIRST, A MEETING OF EXPERTS DURING THE LAST WEEK OF AUGUST TO REVIEW THE CHERNOBYL ACCIDENT;

-- SECOND, AS I HAVE ALREADY MENTIONED A GROUP OF EXPERTS TO DRAFT, ON AN URGENT BASIS, TWO INTERNATIONAL AGREEMENTS; ONE TO PROVIDE FOR THE EARLY NOTIFICATION OF NUCLEAR ACCIDENTS WITH POSSIBLE TRANSBOUNDARY EFFECTS AND THE DISSEMINATION OF COMPREHENSIVE INFORMATION CONCERNING THEM; THE OTHER TO PROVIDE A FRAMEWORK TO FACILITATE INTERNATIONAL ASSISTANCE, INCLUDING EMERGENCY RESPONSE MEASURES, IN THE EVENT OF SUCH ACCIDENTS.

-- THIRD, THE AGENCY'S WORK PROGRAM CALLS FOR A GROUP OF EXPERTS TO CONSIDER, OVER A LONGER PERIOD, ADDITIONAL MEASURES TO IMPROVE COOPERATION IN THE FIELD OF NUCLEAR SAFETY, INCLUDING FURTHER REFINEMENT OF NUCLEAR SAFETY STANDARDS (THIS GROUP WILL CONVENE IN NOVEMBER);

-- AND FOURTH, IT CALLS FOR AN INTERNATIONAL CONFERENCE, UNDER IAEA AUSPICES, TO REVIEW THE FULL RANGE OF NUCLEAR SAFETY MATTERS, INCLUDING RECOMMENDATIONS EMERGING FROM THE VARIOUS EXPERT GROUPS AND FROM THE IAEA SECRETARIAT. A SPECIAL SESSION OF THE GENERAL CONFERENCE OF THE IAEA WILL BE HELD SEPTEMBER 24-26 FOR THE PURPOSE OF ADDRESSING THESE ISSUES.

I THINK IT IS FAIR TO SAY THAT THE TOKYO SUMMIT STATEMENT SERVED AS A GUIDING PRINCIPLE FOR THIS IAEA WORK PROGRAM, AND THAT THE PROGRAM ITSELF PROVIDES A COMPREHENSIVE APPROACH TOWARD FURTHER EXPANDING INTERNATIONAL COOPERATION IN NUCLEAR SAFETY. THE PROPOSAL FOR AN INTERNATIONAL CONFERENCE CLOSELY PARALLELS A VERY CONSTRUCTIVE RECOMMENDATION BY CHANCELLOR HELMUT KOHL OF THE FEDERAL REPUBLIC OF GERMANY. AND THE PROPOSED INTERNATIONAL CONVENTIONS SHOULD BENEFIT FROM WORK DONE EARLIER BY THE UNITED STATES.

SPECIFICALLY, IN 1981 WE HAD PROPOSED AN INTERNATIONAL CONVENTION ON NUCLEAR SAFETY COOPERATION THAT WOULD HAVE REQUIRED PARTIES TO WARN OTHER STATES ABOUT NUCLEAR INCIDENTS HAVING POSSIBLE TRANSBOUNDARY CONSEQUENCES, AND THAT WOULD ESTABLISH AN AGREED FRAMEWORK FOR MUTUAL ASSISTANCE FOLLOWING A NUCLEAR ACCIDENT. ALTHOUGH WE DID NOT RECEIVE WIDESPREAD SUPPORT FOR THE IDEA OF A CONVENTION AT THAT TIME, OUR

PROPOSALS RESULTED IN TWO SETS OF AGENCY "GUIDELINES," ONE DEALING WITH MUTUAL EMERGENCY ASSISTANCE AND THE OTHER WITH REPORTING NUCLEAR EVENTS AND EXCHANGING INFORMATION ON TRANSBOUNDARY RELEASES OF RADIOACTIVE MATERIALS. IN THE WAKE OF CHERNOBYL WE BELIEVE THERE WILL NOW BE SIGNIFICANTLY GREATER SUPPORT FOR ADOPTING CONVENTIONS INCORPORATING THE ESSENCE OF THE EXISTING "GUIDELINES" AND ESTABLISHING THEM AS BINDING COMMITMENTS. IN VIEW OF THE SOVIET REACTORS NOW UNDER CONSTRUCTION IN CUBA, WE WILL OF COURSE GIVE A HIGH PRIORITY TO ENCOURAGING CUBAN AND SOVIET ADHERENCE TO THE PROPOSED CONVENTIONS AT THE EARLIEST POSSIBLE DATE.

THE U.S. HAS ALSO MADE IT KNOWN IN THE IAEA, OF WHICH CUBA IS A MEMBER, OUR INTEREST IN THE SAFETY QUESTION AT CIENFUEGOS. THE IAEA SPONSORS ON SITE SAFETY REVIEWS, CONDUCTED BY SO CALLED OPERATIONAL SAFETY REVIEW TEAMS, (OSARTS). THESE TEAMS ARE USUALLY COMPOSED OF AN INTERNATIONAL STAFF OF TEN TO FIFTEEN REACTOR SAFETY EXPERTS AND USUALLY TAKE TWO TO THREE WEEKS TO COMPLETE SAFETY ASSESSMENTS OF OPERATING REACTORS. ALTHOUGH THESE TEAMS ARE NOT NORMALLY SENT TO REACTORS STILL UNDER CONSTRUCTION, THEY HAVE ON OCCASSION BEEN MADE AVAILABLE TO COUNTRIES WHICH WISH A REVIEW DURING THE CONSTRUCTION STAGE. BOTH MEXICO AND THE PHILLIPINES HAVE FOR EXAMPLE REQUESTED AND RECIEVED THE ASSISSTANCE OF SUCH TEAMS. WE SUPPORT SUCH REVIEWS AND OTHER IAEA SAFETY AND TECHNICAL ASSESSMENTS OF WHICH THE CUBANS MIGHT WISH TO AVAIL THEMSELVES.

In addition to the IAEA, there are other international bodies that play an important role in international nuclear safety efforts. One such is the Nuclear Energy Agency (NEA) of the OECD. The United States has been an active participant in the NEA and will continue to be one. It was at U.S. urging, for example, that the NEA's Committee on the Safety of Nuclear Installations convened on May 9 of this year to review the earliest data concerning the Chernobyl accident. Publication of the Committee's finding that the accident posed no significant risk to public health in OECD countries provided an important reassurance to the publics of these countries. The Committee has just met again (June 27) to conduct a further review. Another NEA committee, on Radiation Protection and Public Health, is scheduled to meet in special session September 1-2 likewise to consider the accident's impact. The United States fully supports the work of these committees and believes it should be coordinated with the work of the IAEA in such a way as to avoid duplication.

The international community, led by the U.S. and other western governments, has responded quickly and firmly to the Chernobyl disaster. Mechanisms for ensuring the safety of nuclear installations are being reinforced and new mechanisms are being developed to cope more effectively with potential future accidents.

IN THE SPECIFIC CASE OF CUBA, I CAN ASSURE YOU THAT THE U.S. GOVERNMENT IS SEEKING COMPLETE INFORMATION ON THOSE REACTORS WHICH ARE UNDER CONSTRUCTION AND WILL URGE CUBA AND THE SOVIET UNION TO ASSURE THAT THEY MEET THE MOST EXACTING STANDARDS OF SAFETY.

Testimony Regarding the Protection of Public Health and Safety in the Event of a Radiological Emergency at a Nuclear Reactor in Cuba

Presented to:

The United States Senate Committee on Governmental Affairs
Subcommittee on Energy, Nuclear Proliferation,
and Governmental Processess
Miami, Florida
June 30, 1986

Presented by:

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Introduction

Because of the existing and continuing possibility of the occurrence of large-scale natural and man made emergencies, the state must be adequately prepared to deal with, reduce vulnerability to, and recover from such emergencies. State emergency management functions must be coordinated to the maximum extent with comparable functions of federal and local governments to ensure the most effective preparation and use of manpower, resources, and facilities in response to emergencies.

The State Emergency Management Act (Chapter 252, Florida Statutes) authorizes the Department of Community Affairs' Division of Emergency Management to prepare a comprehensive plan and program for emergency management in Florida. The Division is responsible for assuring that such plans and programs exist, and that they are integrated into and coordinated with the emergency plans and programs of federal and local governments.

To ensure that prompt and effective protective actions can and will be taken to protect the lives and property of the people of the state, the state has developed and implemented a comprehensive emergency management program which embodies all aspects of pre-emergency preparedness and post-emergency response and recovery. Comprehensive emergency management plans have been developed to evaluate and mitigate the effects of natural disasters and emergencies which may be caused or aggravated by inadequate planning for, and regulation of, public and private facilities and land use. State and local emergency planning

preparedness capabilities are evaluated through periodic exercises. The emergency management needs of state and local governments are identified annually, and a mechanism has been established to distribute and administer funds to address those needs. Public information and education programs have been instituted to educate the public as to what actions they should take during an emergency. Personnel are routinely trained and resources procured to ensure the availability of adequately trained and equipped emergency personnel in time of need.

As a result, I am confident that prompt and effective measures can and will be implemented to protect the health and safety of the public from the harmful effects of radiation released as a result of an accident at a nuclear reactor in Cuba. The following is a summary of Florida's plans and programs that would be used if such an emergency was to occur.

Radiological Emergency Preparedness

Approximately 220,000 persons in 6 counties live within a 10-mile radius of nuclear power plants in Florida and are subject to possible whole-body external exposure to and inhalation of gamma radiation in the event of an emergency. All or portions of 24 additional Florida counties are within a 50-mile radius of nuclear power plants and are subject to the possible ingestion of contaminated food and water during an emergency. It is essential that detailed emergency plans and procedures, addressing a wide range of potential accident parameters and appropriate protective measures, be available for

implementation during an emergency to protect the health and safety of Florida residents.

Following the accident at Three Mile Island, the federal government established emergency planning and preparedness requirements for both the nuclear plant operators (on-site) and state and local governments (off-site). The 1982 Florida Legislature enacted Section 252.60, Florida Statutes, which established the means by which emergency plans and preparedness requirements of the NRC and FEMA could be developed and tested by the state, appropriate counties and the licensed operators of commercial nuclear power plants. To comply with the provisions of this statute, detailed radiological emergency plans have been developed. The Florida Radiological Emergency Management Plan for Nuclear Power Plants identifies the actions to be taken by the State and local governments in preparing for, responding to, and recovering from a nuclear power plant emergency. This plan outlines emergency procedures and actions to be taken by state and local governments in response to radiological emergencies at the Turkey Point and St. Lucie plants operated by Florida Power and Light Company, the Crystal River plant operated by Florida Power Corporation, and the Farley plant operated by Alabama Power Company. The plan:

> identifies the various state, county, and federal response organizations and describes their responsibilities in the event of a radiological emergency;

describes the coordination and management of the emergency response efforts at the state and county levels;

identifies the responsibilities and systems for alerting emergency personnel, activating emergency plans, obtaining assistance from other agencies, and warning the public;

describes the in-place communications systems between the nuclear power plant operator and the state/local governments;

provides guidance for the timely and accurate collection, coordination, and dissemination of information to keep the public informed of potential hazards and emergency actions;

identifies the state, local and licensee emergency response facilities and equipment that would be used to effectively manage a radiological emergency;

establishes the procedures to be used during an emergency at a nuclear power plant to assess the health and safety hazard to the public;

establishes the means for controlling radiological exposure of emergency workers;

provides guidelines for actions that can be taken to protect the public from significant releases of radioactive materials;

describes arrangement for emergency hospital and medical services, and for transporting victims of radiological emergencies to medical support facilities;

outlines the general procedures to be used after a radiological emergency has been brought under control to assure that persons are not allowed to return to a contaminated area until it is safe;

outlines the requirements for periodic radiological exercises and drills to evaluate the plan and the basic skills of emergency response personnel;

provides assurances that emergency personnel are adequately trained to respond to a radiological emergency; and

establishes site-specific procedures and protective actions to ensure the health, safety and welfare of those persons who would be affected by a radiological emergency at each plant.

Emergency plans of the state and local governments and licensees are exercised annually to evaluate their adequacy. Corrective actions are identified as appropriate, and emergency plans and procedures are revised to reflect those actions.

Since its implementation, the State Radiological Emergency Preparedness program has become nationally recognized for its technical and emergency management capabilities. On February 17, 1984, FEMA announced its approval of all state and local radiological emergency plans in Florida. Florida thus

became the fifth state to gain approval of its emergency plans, and the first state with multiple nuclear power plant sites to have all site plans approved. FEMA Director Louis Giuffrida announced that "the teamwork of the Florida nuclear industry, the state and affected local governments has resulted in an exemplary emergency plan."

Florida was selected to host the first exercise and evaluation of the Federal Radiological Emergency Response Plan (FRERP) at the St. Lucie Nuclear Power Plant in March 1984. In a letter to Governor Graham following that exercise, FEMA Associate Director Samuel Speck deemed the exercise an excellent example of cooperation between local, state and federal levels of government and a private utility. Mr. Speck wrote, "the results of the St. Lucie exercise may potentially benefit not only Floridians, but all Americans who may be affected by a serious radiological emergency."

Radiological Protection

Radiological protection programs are designed to provide individual citizens and government officials with the skills, knowledge and guidance necessary to minimize the effects of all types of radiological hazards that could pose a threat to the health and safety of the public. At the state level, the limited availability of federal funds to implement this program has precluded the state's participation in this program. As a result, Radiological Protection Program activities are

coordinated by a number of staff from DCA's Division of Emergency Management. Florida anticipates participating in this program during fiscal year '87.

The local Radiological Officer (RO) is responsible for developing and maintaining a local-level Radiological Protection Program to ensure that local agencies can perform essential services with minimum effects of radiation as a result of a nuclear attack or peacetime radiological emergency. Development and maintenance of this program also include support and participation in training and exercises and the development of a plan to allocate and distribute radiological monitoring instruments to emergency management agencies.

The Division of Emergency Management operates a 100% federally funded Radiological Instrumentation Maintenance and Calibration (RIM&C) facility that provides for the statewide distribution, inspection, maintenance and calibration of more than 71,000 radiological monitoring instruments. This is completed on a four-year cycle to maintain the equipment's operational readiness and reliability. The RIM&C facility in Tallahassee maintains a float stock of instruments to provide serviceable instruments for immediate use, replacement or exchange.

Environmental Surveillance

In addition to their emergency responsibilities under the state's Radiological Emergency Preparedness program, the

Florida Department of Health and Rehabilitative Services (DHRS) maintains and operates an cngoing environmental surveillance program. Three days after the Soviet nuclear accident at Chernobyl, the DHRS implemented several precautionary protective measures to assure the continued health and safety of the public.

Following discussions with the U.S. Environmental Protection Agency (EPA), the DHRS reactivated fallout monitoring stations that had previously been used to monitor radioactive fallout from China's nuclear weapons testing from 1976 to 1980. The EPA and DHRS also have monitoring stations in Jacksonville and Miami, which run continuously with gross beta analyses of particulate filters conducted weekly to test for the presence of naturally occurring Radon - 222 gas. Following Chernobyl, the frequency of analysis and filter change was increased from weekly to daily. After the initial anlaysis was conducted by the respective county health department, the filters were then sent to EPA's Eastern Environmental Radiation Facility in Montgomery for further analysis. Both particulate and precipitation samples were collected and anlayzed at these monitoring stations.

The DHRS also increased the frequency of gross beta analysis and air filter changes at their Orlando monitoring stations from weekly to daily. In addition to the particulate filter normally used, a charcoal filter cartridge was installed to collect gaseous forms of radioactive iodine (which are not normally present in this area). Deactivated monitoring stations in Tallahassee, St. Petersburg, and Pensacola were reactivated

and filter testing was conducted on a daily basis. Precipitation samples were also collected and tested at the Orlando, Tallahassee, St. Petersburg and Pensacola monitoring stations.

In addition to these six fallout monitoring stations, information was available from the weekly samples collected and tested from monitoring stations located near the Crystal River, St. Lucie and Turkey Point Nuclear power plants.

Because of slightly elevated levels of gross beta radiation and the detection of measurable amounts of radioactive iodine and other short-lived materials in the air and precipitation samples, the DHRS and state Department of Agriculture and Consumer Services/Division of Dairy Industries (DACS) conducted a series of precautionary milk samples statewide. Trace levels of radioactive iodine were detected which were insufficient to require any further protective or precautionary measures. The monitoring stations in St. Petersburg, Tallahassee, and Pensacola were subsequently deactivated, and the monitoring stations in Miami, Jacksonville, and Orlando returned to a normal sampling schedule.

In a related incident, the state DHRS was notified of a ship scheduled to arrive in Jacksonville which was docked in the Kiev harbor at the time of the Chernobyl accident. State and federal personnel monitored the ship and its crew upon arrival in Jacksonville. Small levels of contamination were found on the ship, but these levels were not sufficient to prevent its docking in Jacksonville.

Summary

In closing, I would like to point out that the overall capability and integrity of state and local emergency management programs in Florida have been clearly demonstrated during the 1985 hurricane season. During hurricanes Elena and Kate, Florida demonstrated that proper decisions could be made and appropriate and effective actions implemented to protect the health and safety of the public.

In addition, Florida's Radiological Emergency Preparedness program has received national recognition as a result of demonstrated planning and preparedness capabilities. As federal radiological emergency planning and preparedness requirements evolve, Florida will adjust emergency plans and procedures to maintain the level of capability that state, local and utility officials have worked hard to achieve.

These emergency programs, coupled with a sound and effective environmental surveillance program, will help to ensure the health and safety of the public in the event of a radiological release from a nuclear reactor in Cuba.

Thank you.